Port Orchard City Hall Building Improvements

Bid Set

Project Manual

03.31.2023

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ADVERTISEMENT FOR BIDS
CITY OF PORT ORCHARD
CITY HALL RENOVATIONS
PUBLIC WORKS PROJECT NO. PW2023-004

Notice is hereby given that sealed bids will be received at the office of the City Clerk for the City of Port Orchard, 216 Prospect Street, Port Orchard, WA 98366 until **10:30 am** on **May 2, 2023**, for construction of the **City Hall Renovations Project**, Project No PW2023-004. No proposals will be accepted after the above-stated time. Immediately following the above-stated time, the proposals will be publicly opened and read.

The project consists of work to be performed within 308 working days from notice to proceed, and consists of furnishing all materials, equipment, tools, labor, and other work or items incidental theretofore and as generally described as follows:

Project consists of a total envelope replacement including exterior façade, windows, doors, roofing system, and clock system. Project also included HVAC replacement with new controls and LED lighting conversion throughout the building. The project will relocate the main electrical service, add a new backup generator, and add a new photovoltaic system mounted on a prefabricated structure in the parking area. There are four (4) Bid Alternates, including interior renovations and finish replacements throughout the building.

The Engineer's construction estimate for this project, including all Bid Alternates, is $7,400,000. The below construction estimates are a breakdown of the Base Bid and all Bid Alternates.

Base Bid: $5,400,000

Bid Alternate 1: $350,000

Bid Alternate 2: $350,000

Bid Alternate 3: $180,000

Bid Alternate 4: $1,120,000

Access to bidding information (Project Manual, including plans, specifications, addenda, and Bidders List) is available through City of Port Orchard's on-line plan room www.portorchardwa.gov/bids-and-proposals/.

Free-of-charge access is provided to Prime Bidders, Subcontractors, and Vendors by going to www.bxwa.com and clicking on "Posted Projects," "Public Works," and "City of Port Orchard." This on-line plan room provides Bidders with fully usable online documents with the ability to: download, view, print, order full/partial plan sets from numerous reprographic sources, and a free online digitizer/take-off tool. It is recommended that Bidders "Register" in order to receive

automatic email notification of future addenda and to place themselves on the "Self-Registered Bidders List." Bidders that do not register will not be automatically notified of addenda and will need to periodically check the on-line plan room for addenda issued on this project. Contact Builders Exchange of Washington at 425-258-1303 should you require assistance.

If you do not have access to the Web, you may make arrangements to pick up a plan set at the Port Orchard City Hall, City Clerk's Office, 216 Prospect Street, Port Orchard, WA 98366, 360-876-4407, for a NON-REFUNDABLE fee of $100.00. If you wish the bid documents mailed to you, add $20.00 to cover postage. Informational copies of any available maps, plans, specifications, and subsurface information are on file for inspection in the office of the Port Orchard Project Engineer, 216 Prospect Street, Port Orchard, WA 98366.

All bid proposals shall be consistent with the Contract Documents, which include these Instructions to Bidders and all attachments thereto, The Project Manual for the City Hall Renovations Project, the Retainage Options, and the Project Bid Set (sheet A00.01 through E40.05). All bid proposals shall be accompanied by a bid security (bid deposit) in the form of a cash deposit, certified or cashier's check, postal money order, or surety bond made payable to the City of Port Orchard, for a sum not less than five percent (5%) of the amount of such bid, including sales tax. Should the successful bidder fail to enter into such contract and furnish satisfactory payment and performance bonds within the time stated in the Specifications, the bid security (bid deposit/bond) shall be forfeited to the City of Port Orchard.

The award of the Contract will go to the qualified bidder submitting the lowest responsible and responsive bid. The City reserves the right to reject any and all bids or waive any informality or irregularity in the bidding and make the award as deemed to be in the best interest of the City and the public.

The City of Port Orchard in accordance with Title VI of the Civil Rights Act of 1964, 78 Stat. 252, 42 U.S.C. 2000d to 2000d-4 and Title 49, Code of Federal Regulations, Department of Transportation subtitle A, Office of the Secretary, Part 21, nondiscrimination in federally assisted programs of the Department of Transportation issued pursuant to such Act, hereby notifies all bidders that it will affirmatively insure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color or national origin in consideration for an award.

The City is an equal opportunity and affirmative action employer. Small and Minority-owned businesses, women-owned businesses, and labor surplus area firms are encouraged to submit bids.

Notice is given to all potential bidders that any bid responses may be subject to release under the Public Records Act Chapter 42.56 RCW and the City may be required to disclose bid responses upon a request. Bidders are advised to mark any records believed to be trade secrets or

confidential in nature as "confidential." If records marked as "confidential" are found to be responsive to the request for records, the City may elect to give notice to the bidder of the request so as to allow the bidder to seek a protective order from a Court. Please be advised, however, that any records deemed responsive to a public records request may be released at the sole discretion of, and without notice by, the City.

Published: Kitsap Sun –April 7, 2023 and April 14, 2023

Daily Journal of Commerce –April 7, 2023 and April 14, 2023

NOTICE TO PROSPECTIVE BIDDERS
City Hall Renovations Project

It is the City of Port Orchard's policy that questions concerning the project during the bidding process shall be submitted in written form. Please submit any questions that are pertinent to bidding the contract, and that are not answered by information contained in the Contract Documents, to the City of Port Orchard Engineering Department via email at publicworks@portorchardwa.us, Attention: Chris Hammer, PE.

All emails must be received at least 5 business days prior to the bid opening for a response. All prospective bidder questions and the City's response will be sent via Addendum to all prospective bidders approximately 3 days prior to the bid opening.

If you believe the Contract Documents contain an error or error(s), please provide us with that information via email. An addendum will be issued to all prospective bidders if a correction is needed. Addendums will be posted on the City's Website www.portorchardwa.gov/bids-and-proposals/ and Builders Exchange www.bxwa.com

I have the following question(s)/comment(s):

_____

_____

_____

_____

I believe the Contract Document(s) has (have) the following error(s):

_____

_____

_____

_____

Please respond to:

Name: _____

Representing: _____

Address: _____

_____

Email address: _____

Fax Number: _____

INFORMATION AND CHECKLIST FOR BIDDERS

The following supplements the information in the Advertisement for Bids:

1. Pre-Bid Conference

A non-mandatory Pre-bid Conference will be held at the Port Orchard City Hall at 216 Prospect Street, Port Orchard, WA 98366 at the following dates and times.

April 13 @ 9:00 am

April 18 @ 3:00 pm

2. Examination of Plans, Specifications, and Site

Before submitting his/her bid, the Contractor shall carefully examine each component of the Bid Documents and any other available supporting data so as to be thoroughly familiar with all the requirements.

The Bidder shall make an alert, heads-up, eyes-open reasonable examination of the project site and conditions under which the Work is to be performed, including but not limited to: current site topography, soil and moisture conditions; underground obstructions; the obstacles and character of materials which may be encountered; traffic conditions; public and private utilities; the availability and cost of labor; and available facilities for transportation, handling and storage of materials and equipment.

3. Property Issues

All bidders shall base their bids upon full restoration of all property within the right-of-way and easements, and wherever Bidder will have right-of-entry. The easements and right of entry documents that have been acquired are available for inspection and review. The Bidder is advised to review the conditions of the permits, easements, and rights-of-entry, as s/he shall be required to comply with all conditions at no additional cost to the Owner. All other permits, licenses, etc., shall be the responsibility of the Bidder. The Bidder shall comply with the requirements of each.

4. Interpretation of Bid Documents

The Bidder shall promptly notify Owner of any discovered conflicts, ambiguities, or discrepancies in or between, or omissions from the Bid Documents. Questions or comments about these Bid Documents should be directed to the attention of: Chris Hammer, PE, Public Works Director/City Engineer, and sent via email to publicworks@cityofportorchard.us or mail/drop off to 216 Prospect Street, Port Orchard, WA 98366. Questions received less than 10 days prior to the date of bid opening may not be answered. Any interpretation or correction

of the Bid Documents will be made only by addendum, and a copy of such addendum will be distributed through plan holders lists at Builders Exchange www.bxwa.com , the City's Website www.portorchardwa.gov/bids-and-proposals and the City Clerk's Plan holders list The Owner will not be responsible for any other explanations or interpretations of the Bid Documents. No oral interpretations of any provision in the Bid Documents will be made to any Bidder.

5. Bidding Checklist

All bids shall be submitted on the exact forms provided in these Bid Documents, and listed below. Failure to submit any of these forms may be grounds for rejection of the bid. Sealed bids for this proposal shall be submitted as specified in the Advertisement for Bids. Each bid must be submitted in a sealed envelope bearing on the outside the name and address of the Bidder, and the name and number of the project for which the bid is submitted. All bids will remain subject to acceptance for sixty (60) calendar days after the day of the bid opening.

A. **Proposal** – Bidders must bid on all items contained in the Proposal, consistent with all terms and requirements of the Project Manual. If any unit price is left blank, it will be considered no charge for that bid item, regardless of what has been placed in the extension column.

B. **Bid Security** – Bid Bond is to be executed by the Bidder and the surety company unless bid is accompanied by a cash deposit, cashier's or certified check, or postal money order. The amount of this bond shall be not less than five percent (5%) of the total bid, including sales tax, if applicable, and may be shown in dollars. Surety must be authorized to do business in the State of Washington, and must be on the current Authorized Insurance List in the State of Washington, published by the Office of the Insurance Commissioner.

   i. The bond form included in these Contract Provisions MUST be used; no substitute will be accepted. If an attorney-in-fact signs the bond, a certified and effectively dated copy of their Power of Attorney must accompany the bond.

   ii. The bid bond/deposit of the successful Bidder will be returned provided s/he executes the Contract, furnishes satisfactory performance bond covering the full amount of work, provides evidence of insurance coverage, and other documents required by the contract documents within 14 calendar days after Notice of Award. Should s/he fail or refuse to do so, the Bid Deposit or Bond shall be forfeited to the City of Port Orchard as liquidated damages for such failure.

   iii. The Owner reserves the right to retain the security of the three lowest bidders until the successful Bidder has executed the Contract and furnished the performance bond.

C. **Non-Collusion Declaration** – DOT Form 272-036H EF included in these Contract Provisions must be returned with the bid proposal.

D. **Bidder's Qualification Form** – Regarding forms D and E, the Owner reserves the right to check all statements and to judge the adequacy of the Bidders qualifications.

E. **Certification of Compliance with Wage Payment Statutes –** Must be filled in and signed.

F. **Supplemental Criteria Information Form** - Must be filled in and signed.

G. **Subcontractors List** – Must be completed.

6. Contract Checklist

The following forms are to be executed by the successful Bidder after the Contract is awarded. The Contract and Performance and Payment Bond are included in these Bid Documents and should be carefully examined by the Bidder.

A. **Contract** – One copy to be executed by the successful Bidder. Bid and Contract Documents must be executed by the Contractor's President or Vice-President if a corporation, or by a partner if a partnership. In the event another person has been duly authorized to execute contracts, a copy of the resolution or other minutes establishing this authority must be attached to the Proposal and Contract documents.

B. **Performance/Payment Bond and Warranty Bond** – One copy of each type of bond to be executed by the successful Bidder and his surety company. These bonds cover successful completion of all work and payment of all laborers, subcontractors, suppliers, etc. and provide a warranty for the contract work. The bond forms included in these Bid Documents MUST be used; no substitutes will be accepted. If an Attorney-in-fact signs the bond(s), a certified and effectively dated copy of their Power of Attorney must accompany the bond(s).

C. **Certificates of Insurance and endorsements** – To be executed by an insurance company acceptable to the Owner, on ACCORD Forms. The Owner shall be named as "Additional Insured" on the insurance policies.

D. **Selection of Retainage Option** – Pursuant to RCW 60.28.010, 5% retainage will be retained until fulfillment of state and local compliance is documented. The retainage form should be completed by the successful bidder.

E. **Prevailing Wage Requirements** – The Contractor is required to pay, at a minimum, the applicable prevailing wage rates to those employees performing services under the Contract. The applicable wage rates are set forth in the State of Washington Department of Labor and Industries Prevailing Wage Rate Schedule, RCW 39.12.020.

The project site is located in **Kitsap County**.

The prevailing wage schedule in effect for the work under the Contract will be the one in effect upon the prime contractor's bid due date with these exceptions:

- If the project is not awarded within six (6) months of the bid due date, the award date (the date the contract is executed) is the effective date.
- If the project is not awarded pursuant to bids, the award date (the date the contract is executed) is the effective date.
- Janitorial contracts follow WAC 296-127-023.

For Project number **PW2023-004** the prime contractor bid due date is **May 2, 2023.**

Except for janitorial contracts, the rates in effect on the bid due date shall apply for the duration of the contract (unless otherwise noted in the solicitation).

It is the responsibility of the Contractor to ensure the appropriate labor classification(s) are identified and that the applicable wage and benefit rates are taken into consideration when preparing their proposal according to these specifications.

The selected Contractor must submit to the Department of Labor and Industries, a "Statement of Intent to Pay Prevailing Wages". www.lni.wa.gov/licensing-permits/public-works-projects/contractors-employers/#required-documents-for-doing-the-work A copy of the certified Intent Statement must be submitted to the City prior to payment of the first invoice. The Contractor will pay promptly, when due, all wages accruing to its employees.

All invoice or payment applications are required to bear the following signed statement: "I certify that wages paid under this contract are equal to or greater than the applicable wage rates set forth in the Washington State Prevailing Wage Rates for Public Works Contracts issued by the State of Washington Department of Labor and Industries."

The selected Contractor must submit to the Department of Labor and Industries an "Affidavit of Wages Paid" and a copy of an approved Affidavit must be submitted at the end of the contract to the City before the last payment or any retained funds will be released. www.lni.wa.gov/licensing-permits/public-works-projects/contractors-employers/#when-the-work-is-done

The cost of filing a Statement of Intent to Pay Prevailing Wages and Affidavit of Wages Paid with the Department of Labor and Industries shall be at no additional cost to the City.

The Director of the Department of Labor and Industries shall arbitrate all disputes of the prevailing wage rate, RCW 39.12.060 and WAC 296-127-060.

Look up the prevailing rates of pay, benefit, and overtime codes from this link: www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/default.asp A copy of the

prevailing wage rates is available for viewing at the City of Port Orchard Department of Public Works. A hard copy will be mailed upon request.

For prevailing wage questions, contact the Department of Labor & Industries at PW1@Lni.wa.gov or 360-902-5335.

7. Contractor Disqualification

A bidder will be deemed not responsible, and the proposal rejected if the bidder does not meet the following responsibility criteria set forth in RCW 39.04.350, which provides, in part, as follows:

(1) 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;

(d) Not be disqualified from bidding on any public works contract under RCW 39.06.010 or39.12.065(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;

(f) Have received training on the requirements related to public works and prevailing wage under this chapter and chapter 39.12 RCW. The bidder must designate a person or persons to be trained on these requirements. The training must be provided by the department of labor and industries or by a training provider whose curriculum is approved by the department. The department, in consultation with the prevailing wage advisory committee, must determine the length of the training. Bidders that have completed three or more public works projects and have had a valid business license in Washington for three or more years are exempt from this subsection. The department

of labor and industries must keep records of entities that have satisfied the training requirement or are exempt and make the records available on its web site. Responsible parties may rely on the records made available by the department regarding satisfaction of the training requirement or exemption.

(g) Within the three-year period immediately preceding the date of the bid solicitation, not have been 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 to have willfully violated, as defined in RCW 49.48.082, any provision of chapter 49.46, 49.48, or 49.52 RCW.

The Bidder shall submit a signed statement to the City in accordance with Chapter 5.50 RCW verifying under penalty of perjury that (1) the bidder is in compliance with the responsible bidder criteria in subsection (1)(g) above; and (2) that the Contractor is not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency in accordance with Executive Orders 12549 and 12689, 24 C.F.R. Pt. 24.

2) A bidder may be deemed not responsible and the proposal rejected if:

   a. More than one proposal is submitted for the same project from a bidder under the same or different names;

   b. Evidence of collusion exists with any other bidder or potential bidder. Participants in collusion will be restricted from submitting further bids;

   c. The bidder, in the opinion of the Contracting Agency, is not qualified for the work or to the full extent of the bid, or to the extent that the bid exceeds the authorized prequalification amount as may have been determined by a prequalification of the bidder;

   d. An unsatisfactory performance record exists based on past or current Contracting Agency work or for work done for others, as judged from the standpoint of conduct of the work; workmanship; progress; affirmative action; equal employment opportunity practices; or Disadvantaged Business Enterprise, Minority Business Enterprise, or Women's Business Enterprise utilization;

   e. There is uncompleted work (Contracting Agency or otherwise) which might hinder or prevent the prompt completion of the work bid upon;

   f. The bidder failed to settle bills for labor or materials on past or current contracts;

   g. The bidder has failed to complete a written public contract or has been convicted of a crime arising from a previous public contract;

   h. The bidder is unable, financially or otherwise, to perform the work; or

i. There are any other reasons deemed proper by the Contracting Agency.

PROPOSAL

CITY OF PORT ORCHARD
CITY HALL RENOVATIONS PROJECT
PROJECT NO. PW2023-004

To: Mayor and City Council
City of Port Orchard, Washington

Contractor:_____

State License No.: _____

Date: _____
Month/Day/Year

Bidder's Declaration and Understanding

The Bidder declares that they have carefully examined the Contract Documents for the construction of the project, that they have personally inspected the site, that they have satisfied themself as to the quantities involved, including materials and equipment, and conditions of work involved, including the fact that the description of the quantities of work and materials, as included herein, is brief and is intended only to indicate the general nature of the work and to identify the said quantities with the detailed requirements of the Contract Documents, and that this Proposal is made according the provisions and under the terms of the Contract Documents, which Documents are hereby made a part of this Proposal. The Bidder further declares that they has exercised their own judgment regarding the interpretation, of subsurface information and has utilized all data, which they believes pertinent from City and other sources and has made such independent investigations as the Bidder deems necessary in arriving at their conclusions.

Bidder understands that any bid response documents may be subject to release under the Public Records Act Chapter 42.56 RCW and the City may be required to disclose bid responses upon a request. Bidder acknowledges that they have been advised to mark any records believed to be trade secrets or confidential in nature as "confidential." If records marked as "confidential" are found to be responsive to the request for records, the City as a courtesy to the Bidder may elect to give notice to Bidder of the request so as to allow Bidder to seek a protective order from a Court. Bidder acknowledges and agrees that any records deemed responsive to a public records request may be released at the sole discretion of, and without notice by, the City.

Contract Execution

The Bidder agrees that if this Proposal is accepted, the Bidder will, within fourteen (14) calendar days after Notice of Award, complete and sign the Contract in the form annexed hereto, and will at that time deliver to the City executed copies of the Performance Bond, Labor and Material Payment bond, the Certificate of Insurance, and other documentation required by the Contract Documents, and will, to the extent of the Proposal, furnish all machinery, tools, apparatus and

other means of construction and do the work and furnish all the materials or services necessary to complete all work as specified or indicated in the Contract Documents.

Start of Construction and Contract Completion

The Bidder further agrees that within 14 calendar days of CONTRACT START DATE, they will meet with engineering personnel and complete the construction within **308** working days of START DATE.

Lump Sum and Unit Price Work

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 on lump sum and unit price amounts, it being expressly understood that the unit prices are independent of the exact quantities involved. The Bidder agrees that the lump sum prices and the unit prices represent a true measure of the labor, services, and materials required to perform the work, including all allowances for overhead and profit for each type and unit of work called for in these Contract Documents.

If any material, item, or service required by the Contract Documents has not been mentioned specifically, the same shall be furnished and placed with the understanding that the full cost to the City has been merged with prices named in the proposal.

BID PRICE FORM
CITY HALL RENOVATIONS PROJECT
PROJECT NO. PW2023-004

NOTE: The Project must be bid in its entirety, including all bid alternate items as specifically listed in the Proposal, in order to be considered a responsive bid. The Contracting Agency reserves the right to award all work, or any combination of the base bid and bid alternates, according to the lowest qualified responsive bid tendered, available funds, and as it best serves the interest of the Contracting Agency. All work awarded will be made to the same Contractor/bidder. Bidder shall make no stipulation on the Bid Form, nor qualify the bid in any manner.

Bidders Name:_____

SALES TAX

Retailing/Retail Sales Tax Rule WAC 458-20-170 and its related rules, apply to this project for the constructing and repairing of existing buildings, or other structures, upon real property. The Contractor shall collect from the City retail sales tax on the full contract price. The City will automatically add this sales tax to each payment to the Contract. The Contractor shall not include the retail sales tax in the unit bid item prices, with the following exception: The City will not add in sales tax for a payment the Contractor or a subcontractor makes on the purchase or rental of tools, machinery, equipment, or consumable supplies not integrated into the project. Such sales taxes shall be included in the unit bid item prices or in any other contract amount.

All Work is described in the Project Manual and shown on plans and described in the specifications for Project No. PW2023-004 for the City of Port Orchard City Hall Renovations, 216 Prospect Street, Port Orchard, WA 98366. Refer to Sheet A10.01 for a breakdown of the Base Bid and Bid Alternates.

The bidder agrees the lump sum and unit prices entered for the various bid items included in the Bid Schedule include all use taxes, overhead, profit, bond premiums, insurance premiums and all other miscellaneous and incidental expenses as well as all costs of materials, labor, tools and equipment required to perform and complete the work.

LUMP SUM BASE BID AMOUNT

_____ Dollars
(amount in words)

$_____
(amount in numbers)

LUMP SUM BID ALTERNATE #1: Police Station

_____ Dollars
(amount in words)

$_____
(amount in numbers)

LUMP SUM BID ALTERNATE #2: Administration Offices

_____ Dollars
(amount in words)

$_____
(amount in numbers)

LUMP SUM BID ALTERNATE #3: Court Clerk Offices

_____ Dollars
(amount in words)

$_____
(amount in numbers)

LUMP SUM BID ALTERNATE #4: Interior Finishes

_____ Dollars
(amount in words)

$_____
(amount in numbers)

TOTAL OF BASE BID AND ALL BID ALTERNATES

_____ Dollars
(amount in words)

$_____
(amount in numbers)

UNIT PRICES FOR ALL ITEMS MUST BE SHOWN IN THE SPACES PROVIDED BELOW.

Unit price for the following: Material and labor for the removal of exterior sheathing and insulation. Installation of new insulation and exterior sheathing to match adjacent materials. The price is to be per square foot.

_____ Dollars
(amount in words)

$_____
(amount in numbers)

The undersigned Bidder hereby agrees to start construction on this project, if awarded, no later than fourteen (14) calendar days after Notice to Proceed and to complete the project within the time stipulated in the Contract Documents. By signing below, Bidder acknowledges receipt of the following Addenda to the Bid Documents:

CITY OF PORT ORCHARD
CITY HALL RENOVATIONS
PROJECT NO. PW2023-004

_____	_____	_____	_____
Addendum No.	Date of Receipt	Addendum No.	Date of Receipt
_____	_____	_____	_____
Addendum No.	Date of Receipt	Addendum No.	Date of Receipt

NOTE: *Failure to acknowledge receipt of Addenda may be considered as an irregularity in the Bid Proposal and Owner reserves the right to determine whether the bid will be disqualified.*

By signing below, Bidder certifies that s/he has reviewed the insurance provisions of the Bid Documents and will provide the required coverage.

The undersigned Bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date for this Project, 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.

OFFICIAL AUTHORIZED TO SIGN FOR BIDDER:	
"I certify (or declare) under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct."	
Signature:	Date:
Printed Name and Title:	Location or Place Executed (City, State):
Business Address:	Business Telephone:

NOTES: If the Bidder is a co-partnership, give firm name under which business is transacted; proposal must be executed by a partner. If the Bidder is 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).

STATE OF _____)

)ss.

COUNTY OF _____)

I certify that I know or have satisfactory evidence that _____ signed this proposal, on oath stated that he/she was authorized to execute the proposal and acknowledged it as the _____ (title) of _____ (name of party on behalf of whom proposal was executed) and acknowledged it to be his/her free and voluntary act for the uses and purposes mentioned in this proposal.

Dated this _____ day of _____, 20____.

_____
Notary Public

_____
Printed Name

My Commission Expires:
_____

BIDDER'S QUALIFICATION FORM

CITY OF PORT ORCHARD
CITY HALL RENOVATIONS
PROJECT NO. PW2023-004

1. Name of Contractor:

_____

Address:

_____

2. Telephone No.(_____) _____ Fax No.: (_____)_____

Email Address_____

3. Washington State Dept. of Labor and Industries Worker's Compensation Account No.: _____

4. Washington State Dept. of Licensing Contractor's Registration No.: _____ Expiration Date: _____

5. Washington State Uniform Business Identifier No.: _____
(Must have UBI number before the contract is awarded.)

6. Does the Contractor have a City of Port Orchard Business License Yes: _____ No: _____
(A City of Port Orchard Business license is required prior to commencing work pursuant to a written Notice to Proceed)

7. Number of years engaged in contracting business under above name: _____

8. At the time of bid submittal, did the contractor have a certificate of registration in compliance with Chapter 18.27 RCW? _____

9. Does the contractor have industrial insurance coverage for its employees working in Washington as required in Title 51 RCW? (Provide number.) _____

10. Does the contractor have an employment security department number as required in Title 50 RCW? (Provide number): _____

11. Does the contractor have a state excise tax registration number as required in Title 82 RCW? (Provide number): _____

12. Has the contractor been disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3)? _____

13. If project includes Federal funding. Is the Contractor registered in Sam.gov? Yes___ No ____
    Enter Unique ID No. (UEI)_____

14. Has the contractor received training on the requirements related to public works and prevailing wage under chapters 39.04 and 39.12 RCW, as required in RCW 39.04.350(1)(f) _____

15. Within the three-year period immediately preceding the date of the bid solicitation, was the contractor (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) to have willfully violated, as defined in RCW 49.48.082, any provision of chapter 49.46, 49.48, or 49.52 RCW? _____

16. Has the contractor violated the "Off-site Prefabricated Non-Standard Project Specific Items" reporting requirements more than one time as determined by the department of labor and industries? _____

17. Particular types of construction performed by your company:_____

_____

_____

_____

_____

18. Gross amount of contracts now on hand: $ _____

19. List similar recent construction projects that your firm has done in the last 5 years (i.e. new construction, siding replacement, window installation, HVAC and Electrical work, etc.):

Amount	Type	Owner's Name	Phone

20. What is the construction experience of the principal individuals to be assigned to this project?

Name	Title	Years of Construction Experience	Availability

Pursuant to RCW 39.06.020, the contractor further agrees to verify responsibility criteria for each of its subcontractors and to require each of its subcontractors to both verify responsibility criteria as described herein for its subcontractors and include instant condition for verification requirement.

By: _____
(Authorized Signature)

Title: _____

Date: _____

NOTE: Any bidder having current outstanding litigation with the City will not be considered responsible and will be rejected by the City.

BID SECURITY
CITY OF PORT ORCHARD
CITY HALL RENOVATIONS
PROJECT NO. PW2023-004

Bid Deposit:

The undersigned Principal hereby submits a Bid Deposit with the City of Port Orchard in the form of a cash deposit, certified or cashier's check, or postal money order in the amount of _____ Dollars ($_____).

Bid Bond:

KNOW ALL MEN BY THESE PRESENTS: That we, _____, as Principal and _____, as Surety, are held firmly bound unto the City of Port Orchard, Washington, as Obligee, in the penal sum of _____ Dollars, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally by these presents.

The conditions of this obligation are such that if the Obligee shall make any award to the Principal for _____, Port Orchard, Washington, according to the terms of the Proposal or Bid made by the Principal therefore, and the Principal shall duly make and enter into a contract with the Obligee in accordance with the terms of said Proposal or Bid and award and shall give bond for the faithful performance thereof, with Surety or Sureties approved by the Obligee, or if the Principal shall, in case of failure to do so, pay and forfeit to the Obligee the penal amount of the deposit specified in the call for bids, then this obligation shall be null and void; otherwise it shall be and remain in full force and effect and the Surety shall forthwith pay and forfeit to the Obligee, as penalty and liquidated damages, the amount of this Bond.

Signed, Sealed and Dated this _____ day of _____, 20____.

_____	_____
Principal	Surety
_____	_____
Signature of Authorized Official	Signature of Authorized Official
_____	By: _____
Printed Name and Title	Attorney-in-Fact (Attach Power of Attorney)

Name and address of local office of
Agent and/or Surety Company: _____

_____

_____

Surety companies executing bonds must appear on the current Authorized Insurance List in the State of Washington on file with the Office of Insurance Commissioner.

Failure to return this Declaration as part of the bid proposal package will make the bid nonresponsive and ineligible for award.

NON-COLLUSION DECLARATION

I, by signing the proposal, hereby declare, under penalty of perjury under the laws of the United States that the following statements are true and correct:

1. That the undersigned person(s), firm, association or corporation has (have) 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 connection with the project for which this proposal is submitted.
2. **That by signing the signature page of this proposal, I am deemed to have signed and to have agreed to the provisions of this declaration.**

NOTICE TO ALL BIDDERS

To report rigging activities call:

1-800-424-9071

The U.S. Department of Transportation (USDOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m., eastern time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of USDOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the USDOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

DOT Form 272-036H EF
Revised 5/05

CERTIFICATION OF COMPLIANCE WITH WAGE PAYMENT STATUTES

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date **April 7, 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 Officer/Representative*

_____

Printed Name

_____

Title

_____ _____ _____

Date City State

Check One:
Sole Proprietorship ☐ Partnership ☐ Joint Venture ☐ Corporation/LLC ☐

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 or limited liability company, this certificate must be executed in the entity's name by the president or vice-president (or any other corporate officer accompanied by evidence of authority to sign). If a co-partnership, this certificate must be executed by a partner.*

SUPPLEMENTAL CRITERIA INFORMATION FORM

As evidence that the Bidder meets the mandatory and supplemental responsibility criteria, the apparent two lowest Bidders must submit to the Owner by 12:00 p.m. (noon) of the second business day following the bid submittal deadline, this Supplemental Criteria Information Form verifying that the Bidder meets the Mandatory Criteria under RCW 39.04.350(1) and the Supplemental Bidder Criteria stated below. The two lowest Bidders shall also submit supporting documentation including but not limited to that detailed below (sufficient in the sole judgment of the Owner) demonstrating compliance with all mandatory and supplemental responsibility criteria. The Owner reserves the right to request such documentation from other Bidders as well, and to request further documentation as needed to assess Bidder responsibility. The Owner also reserves the right to obtain information from third parties and independent sources of information concerning a Bidder's compliance with the mandatory and supplemental criteria, and to use that information in their evaluation. The Owner may (but is not required to) consider mitigating factors in determining whether the Bidder complies with the requirements of the supplemental criteria.

The basis for evaluation of Bidder compliance with these mandatory and supplemental criteria shall include any documents or facts obtained by Owner (whether from the Bidder or third parties) including but not limited to: (i) financial, historical, or operational data from the Bidder; (ii) information obtained directly by the Owner from others for whom the Bidder has worked, or other public agencies or private enterprises; and (iii) any additional information obtained by the Owner which is believed to be relevant to the matter.

If the Owner determines the Bidder does not meet the bidder responsibility criteria and is therefore not a responsible Bidder or the bid is not responsive, 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 two (2) business days of the Owner's determination by presenting its appeal and any additional information to the Owner. The Owner will consider the appeal and any additional information before issuing its final determination. If the final determination affirms that the Bidder is not responsible (or the bid is not responsive), the Owner will not execute a contract with any other Bidder until at least two business days after the Bidder determined to be not responsible (or the bid not responsive) has received the Owner's final determination.

Request to Change Supplemental Bidder Responsibility Criteria Prior to Bid: Bidders with concerns about the relevancy or restrictiveness of the Supplemental Bidder Responsibility Criteria may make or submit requests to the Owner to modify the criteria. Such requests shall be in writing, describe the nature of the concerns, and propose specific modifications to the criteria. Bidders shall submit such requests to the Owner no later than five (5) business days prior to the bid submittal deadline and address the request to the Project Engineer or such other person designated by the Owner in the Bid Documents.

For criteria with check boxes, the bidder will check either "Yes" or "No." For each "Yes" answer on the form, the Bidder shall provide a signed and dated statement providing the project information requested and explaining the extenuating circumstances.

Project Name:	
Part A. General Company Information	
Company Name:	
Address:	
Contact Phone:	**Contact E-mail:**
Years in business as a Prime Contractor:	**Years in business as a subcontractor:**
Years in business under Present Name:	
List any former company names under which the company, its owners, and/or its principals has operated in the past five (5) years.	
Explain reason for name change(s) in the past five (5 years)	
Part B. Delinquent State Taxes	
Is the bidder listed on the Washington State Department of Revenue's "Delinquent Taxpayer List" website: http://dor.wa.gov/content/fileandpaytaxes/latefiling/dtlwest.aspx	
Yes ☐ **No** ☐	
If "Yes" attach a copy of the written payment plan approved by the Department of Revenue.	
Part C. Federal Debarment	
The bidder shall not be listed as a current debarred or suspended bidder on the Federal "System For Award Management" website www.sam.gov. Is the bidder listed as debarred or suspended?	
Yes ☐ **No** ☐	
Sam.gov Unique Entity ID No._____	

Part D. Subcontractor Responsibility
Does the bidder's standard subcontract form include the subcontractor language required by RCW 39.06.020? Does the bidder have an established procedure which it uses to validate the responsibility of each of its subcontractors? Does the subcontract form require that each of the bidder's subcontractors have and document a similar procedure for sub-tier subcontractors?
Yes ☐ No ☐
If "Yes" or "No", provide a copy of its standard subcontract form and a copy of the procedures used to validate the responsibility of subcontractors.
Part E. Prevailing Wages
In the last five (5) years, has the bidder had prevailing wage complaints filed against it or received violations as determined by the applicable state or federal government agency monitoring prevailing and/or Davis-Bacon wage compliance?
Yes ☐ No ☐
If "Yes," attach a separate signed/dated statement listing the prevailing wage violations, along with an explanation of each violation and how it was resolved. The City shall evaluate these explanations and the resolution of each violation to determine whether the violations demonstrate a pattern of failure to pay prevailing wages to workers unless there are extenuating circumstances acceptable to the City.
Part F. Claims Against Retainage and Bonds
Does the bidder have a record of any claims filed against the retainage or payment bonds for public works projects during the previous three (3) years?
Yes ☐ No ☐
If "Yes", attach a separate signed / dated statement for each project with claims which includes the following: 1) Owner and contact information for the owner; 2) a list of claims filed against the retainage and/or payment bond for the project; and 3) a written explanation of the circumstances surrounding the claim and the ultimate resolution of the claim. The City may contact previous owners to validate the information provided by the Bidder. The City shall evaluate the information to determine if it demonstrates a lack of effective management by the bidder of making timely and appropriate payments, unless there are extenuating circumstances acceptable to the City in its sole discretion.

Part G. Public Bidding Crime
Has the bidder been convicted of a crime involving bidding on a public works contract within the last five (5) years?
Yes ☐ No ☐
Part H. Termination for Cause/Termination for Default
Has the bidder had any public works contract terminated for cause by any government agency during the previous five (5) years?
Yes ☐ No ☐
If "Yes", attach a separate signed / dated statement listing each contract terminated, the government agency terminating the contract and the circumstances involving the termination for cause. The City will determine if there are extenuating circumstances acceptable to the City in its sole discretion.
Part I. Lawsuits
Has the bidder been involved in lawsuits (or arbitrations for those instances where arbitration is completed in lieu of a lawsuit) with judgments entered against the bidder for failure to meet terms on contracts in the previous five (5) years?
Yes ☐ No ☐
If "Yes", attach a list of lawsuits and/or arbitrations with judgments / arbitration awards entered against the bidder along with a written explanation of the circumstances surrounding each lawsuit and/or arbitration.
Part J. Work Experience
List at least three construction projects on the attached Work Experience Form, each of which meet all of the following criteria: • **Successfully completed in the past 7 years.** • **Work including Siding Installation, Window Installation, HVAC, Electrical, or similar work.** • **Contract value exceeding $500,000.00.**

Part K. Signature
I hereby certify, warrant and declare under penalty of perjury that the information included herein is correct and complete. Failure to disclose requested information or submitting false or misleading information may result in rejection of my bid, termination of my contract, and may impact my firm's ability to bid on future projects.
Signature of Authorized Representative **Date**
Printed Name of Authorized Representative **Title**

Work Experience Form

List at least three construction projects on the attached Work Experience Form, each of which meet all of the following criteria:

- Successfully completed within the last seven (7) years.
- Work including siding installation, window installation, HVAC, electrical, or similar work.
- Contract value exceeding $500,000.00.

1. _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   Contract Value $_____

2. _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   Contract Value $_____

3. _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   Contract Value $_____

4. _____
_____
_____
_____
_____
_____
_____
_____

Contract Value $_____

5. _____
_____
_____
_____
_____
_____
_____
_____

Contract Value $_____

SUBCONTRACTOR LIST

Per RCW 39.30.060, the bidder is required to submit as part of the bid the names of the subcontractors with whom the bidder will subcontract for performance of the work of HVAC (heating, ventilation, and air conditioning), plumbing as described in chapter 18.106 RCW, and electrical as described in chapter 19.28 RCW, or to name itself for the work and is also required to list the names of subcontractors with whom the bidder will subcontract for performance of the work of structural steel installation and rebar installation. The bidder shall not list more than one subcontractor for each category of work identified, unless subcontractors vary with bid alternates, in which case the bidder must indicate which subcontractor will be used for which alternate.

The work to be performed is to be listed below the subcontractor(s) name. The requirement to name the bidder's proposed HVAC, plumbing, electrical, structural steel installation, and rebar installation subcontractors applies only to proposed HVAC, plumbing, electrical, structural steel installation, and rebar installation subcontractors who will contract directly with the bidder submitting the bid to the public entity.

Failure to list subcontractors who are proposed to perform the work of HVAC (heating, ventilation and air conditioning), plumbing, and electrical, or to name itself to perform such work, or failing to name subcontractors who are proposed to perform structural steel installation or rebar installation, or naming more than one subcontractor to perform the same work will result in your bid being non-responsive and therefore void.

Subcontractor Name _____
Work to be Performed _____
_____
_____
_____

Subcontractor Name _____
Work to be Performed _____
_____
_____
_____

Subcontractor Name _____
Work to be Performed _____
_____
_____
_____

Subcontractor Name _____
Work to be Performed _____
_____
_____
_____

Subcontractor Name _____
Work to be Performed _____
_____
_____
_____
_____

CONTRACT DOCUMENTS

CONTRACT

CITY OF PORT ORCHARD
CITY HALL RENOVATIONS
CONTRACT NO. _____

THIS CONTRACT ("Contract") is made and entered into this ____ day of _____, 20__, by and between the City of Port Orchard, a municipality incorporated and existing under the laws of the State of Washington, hereinafter called the "City," and _____, hereinafter called the "Contractor."

WITNESSETH:

I. General Provisions.

A. Description of Work.

The Contractor, in consideration of the covenants, agreements and payments to be performed and made by the City, hereby covenants and agrees to furnish all labor, tools, materials, equipment and supplies required for, and to execute, construct and finish in full compliance with the Contract Documents, **City Hall Renovations Project**. The Contractor further agrees to perform all such work for the Contract Price stated in the Contractor's Bid Proposal dated _____, attached hereto and incorporated herein by this reference as if set forth in full. Contractor further represents that the services furnished under this Agreement will be performed in accordance with and as described in the Project Manual, attached plans and specifications, and with the Port Orchard Municipal Code and the City's Public Works Standards. All of these standards are by this reference incorporated herein and made a part hereof. Contractor further represents that the services furnished under this Agreement will be performed in accordance with generally accepted professional practices within the Puget Sound region in effect at the time such services are performed.

The Contract Documents include:

Exhibit A – Confirmed copy of the Proposal made by the Contractor on_____, including all attachments thereto, together with the Notice to Bidders/Instructions to Bidders.

Exhibit B – The Project Manual for the **City Hall Renovations Project**.

Exhibit C – Project Bid Set

Exhibit D – Retainage Options

All Exhibits to this Contract are by this reference incorporated herein and made a part hereof as if set forth in full.

B. Time of Completion.

Time is of the essence of this Contract. It is agreed that the work covered by this Contract shall start within 14 calendar days after Notice to Proceed is issued and that all construction shall be complete within **308 working days** after the Notice to Proceed Date.

II. Non-Discrimination.

During the performance of this Contract, the Contractor, for itself, its assignees, and successors in interest agrees to comply with the following non-discrimination statutes and authorities; including but not limited to compliance with the following Pertinent Non-Discrimination Authorities:

- Title VI of the Civil Rights Act of 1964 (42 U .S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 C.F.R. Part 21.
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 et seq.), (prohibits discrimination on the basis of sex);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 C.F.R. Part 27;
- The Age Discrimination Act of 1975, as amended, (42 U .S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC§ 471, Section 4 7123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub- recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189) as implemented by Department of Transportation regulations at 49 C.P.R. parts 37 and 38;
- The Federal Aviation Administration's Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures discrimination against minority populations by discouraging programs, policies, and activities with disproportionately

high and adverse human health or environmental effects on minority and low-income populations;

- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to -ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

Title VI of the Civil Rights Act of 1964

The City of Port Orchard, in accordance with Title VI of the Civil Rights Act of 1964, 78 Stat. 252, 42 U.S.C. 2000d to 2000d-4 and Title 49, Code of Federal Regulations, Department of Transportation subtitle A, Office of the Secretary, Part 21, nondiscrimination in federally assisted programs of the Department of Transportation issued pursuant to such Act, must affirmatively ensure that its contracts comply with these regulations.

Also, in accordance with Title VI, the City is required to include the following clauses in every contract subject to Title VI and its related regulations.

Therefore, during the performance of this Contract, the Contractor, for itself, its assignees, and successors in interest agrees as follows:

1. **Compliance with Regulations:** The Contractor will comply with the Acts and the regulations relative to Nondiscrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this Contract.

2. **Nondiscrimination:** The Contractor, with regard to the work performed by it during this Contract, will not discriminate on the grounds of race, color, national origin, sex, age, disability, income-level, or LEP in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations as set forth herein, including employment practices when this Contract covers any activity, project, or program set forth in Appendix B of 49 C.F.R. part 21.

3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the Contractor for work to be performed under a subcontract, **including** procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the Contractor of the Contractor's obligations under this Contract and the Acts and the

Regulations relative to Non-discrimination on the grounds of race, color, national origin, sex, age, disability, income-level, or LEP.

4. **Information and Reports:** The Contractor will provide all information and reports required by the Acts, the Regulations and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the City or the FHWA to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of the Contractor is in the exclusive possession of another who fails or refuses to furnish the information, the Contractor will so certify to the City or the FHWA, as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of the Contractor's noncompliance with the Non-discrimination provisions of this Contract, the City will impose such contract sanctions as it or the FHWA may determine to be appropriate, including, but not limited to:
    1. withholding payments to the Contractor under the Contract until the Contractor complies; and/or
    2. cancelling, terminating, or suspending the Contract, in whole or in part.

6. **Incorporation of Provisions:** The Contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The Contractor will take action with respect to any subcontract or procurement as the City or the FHWA may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the Contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the Contractor may request the City to enter into any litigation to protect the interests of the City. In addition, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

III. Public Records Act Chapter 42.56 RCW

Contractor understands that her/his bid response documents, and any contract documents may be subject to release under the Public Records Act Chapter 42.56 RCW and the City may be required to disclose such documents upon a request. Contractor acknowledges that s/he has been advised to mark any records believed to be trade secrets or confidential in nature as "confidential." If records marked as "confidential" are found to be responsive to the request for records, the City as a courtesy to the Contractor, may elect to give notice to Contractor of the request so as to allow Contractor to seek a protective order from a Court. Contractor acknowledges and agrees that any records deemed responsive to a public records request may be released at the sole discretion of, and without notice by, the City.

IV. Termination

The City may terminate this contract for cause or for convenience.

- **Termination for Cause.** The City may, upon 7 days written notice to Contractor and to its surety, terminate (without prejudice to any right or remedy of the City) the contract, or any part of it, for cause upon the occurrence of any one or more of the following events: Contractor fails to complete the work or any portion thereof with sufficient diligence to ensure substantial completion of the work within the contract time; Contractor is adjudged bankrupt, makes a general assignment for the benefit of its creditors, or a receiver is appointed on account of its insolvency; Contractor fails in a material way to replace or correct work not in conformance with the Contract Documents, Contractor repeatedly fails to supply skilled workers or proper materials or equipment; Contractor materially disregards or fails to comply with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction; or Contractor is otherwise in material breach of any provision of the contract. Upon termination, the City may, at its option, take possession of or use all documents, materials, equipment, tools, and construction equipment and machinery thereon owned by Contractor to maintain the orderly progress of, and to finish, the work, and finish the work by whatever other reasonable method it deems expedient.

- **Termination for Convenience.** The City may, upon written notice, terminate (without prejudice to any right or remedy of the City) the contract, or any part of it, for the convenience of the City.

- **Settlement of Costs.** If the City terminates for convenience, Contractor shall be entitled to make a request for an equitable adjustment for its reasonable direct costs incurred prior to the effective date of the termination, plus a reasonable allowance for overhead and profit on work performed prior to termination, plus the reasonable administrative costs of the termination, but shall not be entitled to any other costs or damages, whatsoever, provided however, the total sum payable upon termination shall not exceed the Contract Sum reduced by prior payments.

V. Corporate Surety Bond

With this Contract, Contractor is furnishing a Corporate Surety Bond in the amount of

_____ Dollars ($_____) with _____ as Surety, to ensure full compliance, execution and performance of this Contract by the Contractor in accordance with all its terms and provisions.

VI. Independent Contractor.

The parties intend that an Independent Contractor-Employer Relationship will be created by this Agreement and that the Contractor has the ability to control and direct the performance and details of its work, the City being interested only in the results obtained under this Agreement.

VII. Employment of State Retirees.

The City is a "DRS-covered employer" which is an organization that employs one or more members of any retirement system administered by the Washington State Department of Retirement Systems (DRS). Pursuant to RCW 41.50.139(1) and WAC 415-02-325(1), the City is required to elicit on a written form if any of the Contractor's employees providing services to the City retired using the 2008 Early Retirement Factors (ERFs), or if the Contractor is owned by an individual who retired using the 2008 ERFs, and whether the nature of the service and compensation would result in a retirement benefit being suspended. Failure to make this determination exposes the City to significant liability for pension overpayments. As a result, before commencing work under this Agreement, Contractor shall determine whether any of its employees providing services to the City or any of the Contractor's owners retired using the 2008 ERFs, and shall immediately notify the City and shall promptly complete the form provided by the City after this notification is made. This notification to DRS could impact the payment of retirement benefits to employees and owners of Contractor. Contractor shall indemnify, defend, and hold harmless the City from any and all claims, damages, or other liability, including attorneys' fees and costs, relating to a claim by DRS of a pension overpayment caused by or resulting from Contractor's failure to comply with the terms of this provision. This provision shall survive termination of this Agreement.

VIII. Changes.

The City may issue a written change order for any change in the Contract work during the performance of this Agreement. If the Contractor determines, for any reason, that a change order is necessary, Contractor must submit a written change order request to the person listed in the Notice provision section of this Agreement, within fourteen (14) calendar days of the date Contractor knew or should have known of the facts and events giving rise to the requested change. If the City determines that the change increases or decreases the Contractor's costs or time for performance, the City will make an equitable adjustment. The City will attempt, in good faith, to reach agreement with the Contractor on all equitable adjustments. However, if the parties are unable to agree, the City will determine the equitable adjustment as it deems appropriate. The Contractor shall proceed with the change order work upon receiving either a written change order from the City or an oral order from the City before actually receiving the written change order. If the Contractor fails to require a change order within the time specified in this paragraph, the Contractor waives its right to make any claim or submit subsequent change order requests for that portion of the contract work. If the Contractor disagrees with the equitable adjustment, the Contractor must complete the change order work; however, the Contractor may elect to protest the adjustment as provided in subsections A through E of Section IX entitled, "Claims," below.

The Contractor accepts all requirements of a change order by: (1) endorsing it, (2) writing a separate acceptance, or (3) not protesting in the way this section provides. A change order that is accepted by Contractor as provided in this section shall constitute full payment and final settlement of all claims for contract time and for direct, indirect and consequential costs, including costs of delays related to any work, either covered or affected by the change.

IX. Claims. If the Contractor disagrees with anything required by a change order, another written order, or an oral order from the City, including any direction, instruction, interpretation, or determination by the City, the Contractor may file a claim as provided in this section. The Contractor shall give written notice to the City of all claims within fourteen (14) calendar days of the occurrence of the events giving rise to the claims, or within fourteen (14) calendar days of the date the Contractor knew or should have known of the facts or events giving rise to the claim, whichever occurs first. Any claim for damages, additional payment for any reason, or extension of time, whether under this Agreement or otherwise, shall be conclusively deemed to have been waived by the Contractor unless a timely written claim is made in strict accordance with the applicable provisions of this Agreement.

At a minimum, a Contractor's written claim shall include the information set forth in subsections A, items 1 through 5 below.

FAILURE TO PROVIDE A COMPLETE, WRITTEN NOTIFICATION OF CLAIM WITHIN THE TIME ALLOWED SHALL BE AN ABSOLUTE WAIVER OF ANY CLAIMS ARISING IN ANY WAY FROM THE FACTS OR EVENTS SURROUNDING THAT CLAIM OR CAUSED BY THAT DELAY.

A. Notice of Claim. Provide a signed written notice of claim that provides the following information:

1. The date of the Contractor's claim;

2. The nature and circumstances that caused the claim;

3. The provisions in this Agreement that support the claim;

4. The estimated dollar cost, if any, of the claimed work and how that estimate was determined; and

5. An analysis of the progress schedule showing the schedule change or disruption if the Contractor is asserting a schedule change or disruption.

B. Records. The Contractor shall keep complete records of extra costs and time incurred as a result of the asserted events giving rise to the claim. The City shall have access to any of the Contractor's records needed for evaluating the protest.

The City will evaluate all claims, provided the procedures in this section are followed. If the City determines that a claim is valid, the City will adjust payment for work or time by an equitable adjustment. No adjustment will be made for an invalid protest.

C. Contractor's Duty to Complete Protested Work. In spite of any claim, the Contractor shall proceed promptly to provide the goods, materials and services required by the City under this Agreement.

D. Failure to Protest Constitutes Waiver. By not protesting as this section provides, the Contractor also waives any additional entitlement and accepts from the City any written or oral order (including directions, instructions, interpretations, and determination).

E. Failure to Follow Procedures Constitutes Waiver. By failing to follow the procedures of this section, the Contractor completely waives any claims for protested work and accepts from the City any written or oral order (including directions, instructions, interpretations, and determination).

X. Limitation Of Actions.

CONTRACTOR MUST, IN ANY EVENT, FILE ANY LAWSUIT ARISING FROM OR CONNECTED WITH THIS AGREEMENT WITHIN 120 CALENDAR DAYS FROM THE DATE THE CONTRACT WORK IS

COMPLETE OR CONTRACTOR'S ABILITY TO FILE THAT CLAIM OR SUIT SHALL BE FOREVER BARRED. THIS SECTION FURTHER LIMITS ANY APPLICABLE STATUTORY LIMITATIONS PERIOD.

XI. Warranty.

Upon acceptance of the contract work, Contractor must provide the City a two-year warranty bond in the amount of twenty percent (20%) of the contract price a form and amount acceptable to the City. The Contractor shall correct all defects in workmanship and materials within two (2) years from the date of the City's acceptance of the Contract work, including replacing vegetation that fails to thrive. In the event any parts are repaired or replaced, only original replacement parts shall be used—rebuilt or used parts will not be acceptable. When defects are corrected, the warranty for that portion of the work shall extend for one (1) additional year from the date such correction is completed and accepted by the City. The Contractor shall begin to correct any defects within seven (7) calendar days of its receipt of notice from the City of the defect. If the Contractor does not accomplish the corrections within a reasonable time as determined by the City, the City may complete the corrections and the Contractor shall pay all costs incurred by the City in order to accomplish the correction.

XII. Indemnification.

Contractor shall defend, indemnify, and hold the City, its officers, officials, employees, agents and volunteers harmless from any and all claims, injuries, damages, losses or suits, including all legal costs and attorney fees, arising out of or in connection with the Contractor's performance of this Agreement, except for that portion of the injuries and damages caused by the sole negligence of the City.

The City's inspection or acceptance of any of Contractor's work when completed shall not be grounds to avoid any of these covenants of indemnification.

Should a court of competent jurisdiction determine that this Agreement is subject to RCW 4.24.115, then, in the event of liability for damages arising out of bodily injury to persons or damages to property caused by or resulting from the concurrent negligence of the Contractor and the City, its officers, officials, employees, agents and volunteers, the Contractor's liability hereunder shall be only to the extent of the Contractor's negligence.

It is further specifically and expressly understood that the indemnification provided herein constitutes the contractor's waiver of immunity under Industrial Insurance, Title 51 RCW, solely for the purposes of this indemnification. The parties further acknowledge that they have mutually negotiated this waiver.

THE PROVISIONS OF THIS SECTION SHALL SURVIVE THE EXPIRATION OR TERMINATION OF THIS AGREEMENT.

XIII. Insurance.

The Contractor shall procure and maintain for the duration of the Agreement, insurance against claims for injuries to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the Contractor, its agents, representative, employees or subcontractors.

No Limitation. Contractor's maintenance of insurance as required by the agreement shall not be construed to limit the liability of the Contractor to the coverage provided by such insurance, or otherwise limit the City's recourse to any remedy available at law or in equity.

A. Minimum Scope of Insurance. Contractor shall obtain insurance of the types described below:

1. Automobile Liability insurance covering all owned, non-owned, hired and leased vehicles. Coverage shall be written on Insurance Services Office (ISO) form CA 00 01 or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage.

2. Commercial General Liability insurance shall be written on ISO occurrence form CG 00 01 and shall cover liability arising from premises, operations, stop gap liability, independent contractors, products-completed operations, personal injury and advertising injury, and liability assumed under an insured contract. The Commercial General Liability insurance shall be endorsed to provide the Aggregate Per Project Endorsement ISO form CG 25 03 11 85. There shall be no endorsement or modification of the Commercial General Liability insurance for liability arising from explosion, collapse or underground property damage. The City shall be named as an insured under the Contractor's Commercial General Liability insurance policy with respect to the work performed for the City using ISO Additional Insured endorsement CG 20 10 10 01 and Additional Insured-Completed Operations endorsement CG 20 37 10 01 or substitute endorsements providing equivalent coverage.

3. Workers' Compensation coverage as required by the Industrial Insurance laws of the State of Washington.

4. Builders Risk insurance covering interests of the City, the Contractor, Subcontractors, and Sub-subcontractors in the work. Builders Risk insurance shall be on a all-risk policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including flood and earthquake, theft, vandalism, malicious mischief, collapse, temporary buildings and debris removal. This Builders Risk insurance covering the work will have a deductible of $5,000 for each occurrence, which will be the responsibility of the Contractor. Higher deductibles for flood and earthquake perils may be accepted by the City upon written request by the Contractor and written acceptance

by the City. Any increased deductibles accepted by the City will remain the responsibility of the Contractor. The Builders Risk insurance shall be maintained until final acceptance of the work by the City.

B. Minimum Amounts of Insurance. Contractor shall maintain the following insurance limits:

1. Automobile Liability insurance with a minimum combined single limit for bodily injury and property damage of $1,000,000 per accident.

2. Commercial General Liability insurance shall be written with limits no less than $5,000,000 each occurrence, $10,000,000 general aggregate and a $10,000,000 products-completed operations aggregate limit.

3. Builders Risk insurance shall be written in the amount of the completed value of the project with no coinsurance provisions.

C. Other Insurance Provisions. The insurance policies are to contain, or be endorsed to contain, the following provisions for Automobile Liability, Commercial General Liability and Builders Risk insurance:

1. The Contractor's insurance coverage shall be primary insurance as respect the City. Any insurance, self-insurance, or insurance pool coverage maintained by the City shall be excess of the Contractor's insurance and shall not contribute with it.

2. The Contractor's insurance shall be endorsed to state that coverage shall not be cancelled by either party, except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the City.

D. Contractor's Insurance for Other Losses. The Contractor shall assume full responsibility for all loss or damage from any cause whatsoever to any tools, Contractor's employee-owned tools, machinery, equipment, or motor vehicles owned or rented by the Contractor, or the Contractor's agents, suppliers or contractors as well as to any temporary structures, scaffolding and protective fences.

E. Waiver of Subrogation. The Contractor and the City waive all rights against each other any of their Subcontractors, Sub-subcontractors, agents and employees, each of the other, for damages caused by fire or other perils to the extend covered by Builders Risk insurance or other property insurance obtained pursuant to the Insurance Requirements Section of this Contract or other property insurance applicable to the work. The policies shall provide such waivers by endorsement or otherwise.

F. Acceptability of Insurers. Insurance is to be placed with insurers with a current A.M. Best rating of not less than A:VII.

G. Verification of Coverage. Contractor shall furnish the City with original certificates and a copy of the amendatory endorsements, including but not necessarily limited to the additional insured endorsement, evidencing the Automobile Liability and Commercial General Liability insurance of the Contractor before commencement of the work. Before any exposure to loss may occur, the Contractor shall file with the City a copy of the Builders Risk insurance policy that includes all applicable conditions, exclusions, definitions, terms and endorsements related to this Project.

H. Subcontractors. Contractor shall ensure that each subcontractor of every tier obtain at a minimum the same insurance coverage and limits as stated herein for the Contractor (with the exception of Builders Risk insurance). Upon request the City, the Contractor shall provide evidence of such insurance.

XIV. WORK PERFORMED AT CONTRACTOR'S RISK. Contractor shall take all necessary precautions and shall be responsible for the safety of its employees, agents, and subcontractors in the performance of the contract work and shall utilize all protection necessary for that purpose. All work shall be done at Contractor's own risk, and Contractor shall be responsible for any loss of or damage to materials, tools, or other articles used or held for use in connection with the work.

XV. <u>Miscellaneous Provisions</u>.

A. Non-Waiver of Breach. The failure of the City to insist upon strict performance of any of the covenants and agreements contained in this Agreement, or to exercise any option conferred by this Agreement in one or more instances shall not be construed to be a waiver or relinquishment of those covenants, agreements or options, and the same shall be and remain in full force and effect.

B. Resolution of Disputes and Governing Law. This Agreement shall be governed by and construed in accordance with the laws of the State of Washington. If the parties are unable to settle any dispute, difference or claim arising from the parties' performance of this Agreement, the exclusive means of resolving that dispute, difference or claim, shall only be by filing suit exclusively under the venue, rules and jurisdiction of the Kitsap County Superior Court, Kitsap County, Washington, unless the parties agree in writing to an alternative dispute resolution process. In any claim or lawsuit for damages arising from the parties' performance of this Agreement, each party shall pay all its legal costs and attorney's fees incurred in defending or bringing such claim or lawsuit, including all appeals, in addition to any other recovery or award provided by law; provided, however, nothing in this paragraph shall be construed to limit the City's right to indemnification under Section XII of this Agreement.

C. Written Notice. All communications regarding this Agreement shall be sent to the parties at the addresses listed on the signature page of the Agreement, unless notified to the contrary. Any written notice hereunder shall become effective three (3) business days after the date of

mailing by registered or certified mail, and shall be deemed sufficiently given if sent to the addressee at the address stated in this Agreement or such other address as may be hereafter specified in writing.

D. Assignment. Any assignment of this Agreement by either party without the written consent of the non-assigning party shall be void. If the non-assigning party gives its consent to any assignment, the terms of this Agreement shall continue in full force and effect and no further assignment shall be made without additional written consent.

E. Modification. No waiver, alteration, or modification of any of the provisions of this Agreement shall be binding unless in writing and signed by a duly authorized representative of the City and Contractor.

F. Entire Agreement. The written provisions and terms of this Agreement, together with any Exhibits attached hereto, shall supersede all prior verbal statements of any officer or other representative of the City, and such statements shall not be effective or be construed as entering into or forming a part of or altering in any manner this Agreement. All of the above documents are hereby made a part of this Agreement. However, should any language in any of the Exhibits to this Agreement conflict with any language contained in this Agreement, the terms of this Agreement shall prevail.

G. Compliance with Laws. The Contractor agrees to comply with all federal, state, and municipal laws, rules, and regulations that are now effective or in the future become applicable to Contractor's business, equipment, and personnel engaged in operations covered by this Agreement or accruing out of the performance of those operations.

H. Counterparts. This Agreement may be executed in any number of counterparts, each of which shall constitute an original, and all of which will together constitute this one Agreement.IN WITNESS WHEREOF the parties hereto have caused these presents to be duly executed.

CITY OF PORT ORCHARD

By: _____
Robert Putaansuu, Mayor

CONTRACTOR

By: _____

Title: _____

Address: _____

_____

ATTEST:

_____

Brandy Wallace, MMC, City Clerk

APPROVED AS TO FORM:

_____

Charlotte Archer, City Attorney

NOTICES TO BE SENT TO:

CONTRACTOR:	**CITY**
NAME _____	**NAME: Robert Putaansuu, Mayor**
ADDRESS _____	**216 Prospect Street, Port Orchard, WA 98366**
TELEPHONE _____	**TELEPHONE: 360 876-4407**
Email _____	**Email: CityClerk@portorchardwa.gov**

With a copy to the City Clerk at the same address

EXHIBIT C

5% RETAINAGE INVESTMENT OPTION[1]

Contractor: _____

Project Name: _____

Date: _____ Project Number: _____

Pursuant to RCW 60.28.010, as amended, you may exercise an option as to how the 5% retainage under this contract will be invested. Please complete and sign this form indication your preference. If you fail to do so 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 this is your choice, then please complete attached *SAVINGS ACCOUNT AGREEMENT.* Please state the name of your bank.

Bank:_____

☐ 2. **Escrow/Investments:** The City 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. If this is your choice then please complete attached *ESCROW AGREEMNT.*

Preferred Bank: _____

Securities/Bonds: _____

☐ 3. **Guarantee Deposit:** Retainage will be held by the City. No interest is payable to the Contractor

Retainage is normally released 45 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 longer, due to its seasonal nature. However, if this project is subject to grant funding, then the retainage may also be held until such time as the Contractor meets its obligations to the City to provide required information and documentation for compliance with the grant funding requirements.

State law allows for limited early release of retainage in certain circumstance.

_____
Contractor's Signature

_____
Title

[1] If the Contractor opts to post a retainage bond under RCW 60.28.011, such bond shall be in a form acceptable to the City, shall be with a surety with a minimum of A.M. Best financial strength rating of a minimum of A-.

SAVING ACCOUNT AGREEMENT

TO BANK: _____ SAVINGS ACCOUNT NO: _____

BANK'S ADDRESS: _____

_____

AGENCY: CITY OF PORT ORCHARD
216 Prospect Street
Port Orchard WA 98366

CONTRACT NO: _____

PROJECT TITLE:_____

The estimated completion date of contract is: _____

The undersigned, _____, herein referred to as the CONTRACTOR, has directed the CITY OF PORT ORCHARD, Washington, hereinafter referred to as the AGENCY, to deliver to you its warrants which shall be payable to you and the CONTRACTOR jointly. Such warrants are to be held and disposed of by you in accordance with the following instructions and upon the terms and conditions hereinafter set forth.

INSTRUCTIONS

1. Warrants or checks made payable to you and the CONTRACTOR jointly upon delivery to you shall be endorsed by you and forwarded for collection. The moneys will then be placed by you in an interest-bearing savings account.
2. When and as interest on the savings account accrues and is paid, you shall collect such interest and forward it to the CONTRACTOR at its address designated below unless otherwise director by the CONTRACTOR.
3. You are not authorized to deliver to the CONTRACTOR all or any part of the principal held by you pursuant to this agreement, except in accordance with written instruction from the AGENCY. Compliance with such instructions shall relieve you of any further liability related thereto.
4. The CONTRACTOR agrees to pay you as compensation for your services hereunder as follows:

   Payment of all fees shall be the sole responsibility of the CONTRACTOR and shall not be deducted from any moneys placed with you pursuant to this agreement until and unless the AGENCY directs the release to the CONTRACTOR, whereupon you shall be granted a first lien upon such moneys released and shall be entitled to reimburse yourself from such moneys for the entire amount of your fees as provided for herein above. In the event that you are made a party to any litigation with respect

to the moneys held by you hereunder, or in the event that the conditions of this agreement are not promptly fulfilled, or that you are required to render any service not provided for in these instructions, or that there is any assignment of the interests of this agreement, or any modification hereof, you shall be entitled to reasonable compensation for such extraordinary services from the CONTRACTOR and reimbursement from the CONTRACTOR for all costs and expenses, including attorney fees occasioned by such default, delay, controversy or litigation.

5. This agreement shall not be binding until executed by the CONTRACTOR and the AGENCY and accepted by you.
6. This instrument contains the entire agreement between you, the CONTRACTOR and the AGENCY. You are not a party to nor bound by any instrument or agreement other than this. You shall not be required to take notice of any default or any other matter nor be bound by nor required to give notice or demand, nor required to take any action whatever except as herein expressly provided. You shall not be liable for any loss or damage not caused by your own negligence or willful misconduct.
7. The foregoing provisions shall be binding upon the assigns, successors, personal representative and heir of the Parties hereto.

_____	CITY OF PORT ORCHARD
Contractor	*Agency*
BY:_____	BY:_____
Title: _____	
Date: _____	Date: _____
Address: _____	

The above savings account agreement and instruction received and accepted this _____ day of _____, 20___

_____

Bank Name

_____

Authorized Bank Officer

ESCROW AGREEMENT

TO BANK: _____ ESCROW NO.: _____

BANK'S ADDRESS: _____

_____

AGENCY: CITY OF PORT ORCHARD
216 Prospect Street
Port Orchard WA 98366

CONTRACT NO.: _____

PROJECT TITLE:_____

The estimated completion date of contract is: _____

The undersigned, _____, herein referred to as the CONTRACTOR, has directed the CITY OF PORT ORCHARD, Washington, hereinafter referred to as the AGENCY, to deliver to you its warrants which shall be payable to you and the CONTRACTOR jointly. Such warrants are to be held and disposed of by you in accordance with the following instructions and upon the terms and conditions hereinafter set forth.

INSTRUCTIONS

1. Warrants or checks made payable to you and the CONTRACTOR jointly upon delivery to you shall be endorsed by you and forwarded for collection. The moneys will then be used by you to purchase, as directed by the CONTRACTOR, bonds or other securities chosen by the CONTRACTOR and approved by the AGENCY. Attached is a list of such bonds, or other securities approved by the AGENCY. Other bonds or securities, except stocks may be selected by the CONTRACTOR, subject to express written approval of the AGENCY. Purchase of such bonds or other securities shall be in a form which shall allow you alone to reconvert such bonds or other securities into money if you are required to do so by the AGENCY as provided in Paragraph 4 of this Escrow Agreement.
2. When and as interest on the securities held by you pursuant to this agreement accrues and is paid, you shall collect such interest and forward it to the CONTRACTOR at its address designated below unless otherwise directed by the CONTRACTOR.

3. You are not authorized to deliver to the CONTRACTOR all or any part of the securities held by you pursuant to this agreement (or any moneys derived from the sale of such securities, or the negotiation of the AGENCY'S warrants) except in accordance with written instructions from the AGENCY. Compliance with such instruction shall relieve you of any further liability related thereto.

4. In the event the AGENCY orders you to do so in writing, you shall within thirty-five (35) days of receipt of such order, reconvert into money the securities held by you pursuant to this agreement and return such money together with any other moneys held by you hereunder, to the AGENCY.

5. The CONTRACTOR agrees to pay you as compensation for your services hereunder as follows:

   Payment of all fees shall be the sole responsibility of the CONTRACTOR and shall not be deducted from any property placed with you pursuant to this agreement until and unless the AGENCY directs the release to the CONTRACTOR of the securities and moneys held hereunder whereupon you shall be granted a first lien upon such property released and shall be entitled to reimburse yourself from such property for the entire amount of your fees as provided for herein above. In the event that are made a party to any litigation with respect to the property held by you hereunder, or in the event that the conditions of this escrow are not promptly fulfilled or that you are required to render any service not provided for in these instructions, or that there is any assignment of the interest of this escrow or any modification hereof, you shall be entitled to reasonable compensation for such extraordinary services from the CONTRACTOR and reimbursement from the CONTRACTOR for all costs and expenses, including attorney fees occasioned by such default, delay, controversy or litigation.

6. This agreement shall not be binding until executed by the CONTRACTOR and the AGENCY and accepted by you.

7. This instrument contains the entire agreement between you, the CONTRACTOR and the AGENCY with respect to this escrow and you are not a party to nor bound by any instrument or agreement other than this; you shall not be required to take notice of any default or any other matter nor be bound by nor be bound by nor required to give notice or demand , nor required to take action whatever except as herein expressly provided; you shall not be liable for any loss or damage not caused by your own negligence or willful misconduct.

The foregone provision shall be binding upon the assigns, successors, personal representative, and heir of the Parties hereto.

_____	CITY OF PORT ORCHARD
Contractor	*Agency*
By: _____	By: _____
Title: _____	
Date: _____	Date: _____
Address: _____	

The above escrow agreement and instruction received and accepted this _____ day of _____, 20__.

_____

Bank Name

_____

Authorized Bank Officer

SECURITIES AUTHORIZED BY AGENCY

1. Bills, certificates, notes or bonds of the United States;
2. Other obligations of the United States or its agencies;
3. Obligation of any corporation wholly-owned by the government of the United States;
4. Indebtedness of the Federal Nation Mortgage Association; and
5. Time deposits in commercial banks.

PERFORMANCE AND PAYMENT BOND

CITY OF PORT ORCHARD
CITY HALL RENOVATIONS PROJECT
PUBLIC WORKS PROJECT NO. PW2023-004
Bond to City of Port Orchard, Washington
Bond No. _____

We, _____, and_____
(Principal) (Surety)

a _____ Corporation, and as a surety corporation authorized to become a surety upon Bonds of Contractors with municipal corporations in Washington State, are jointly and severally bound to the City of Port Orchard, Washington ("Owner"), in the penal sum of _____ Dollars ($_____), the payment of which sum, on demand, we bind ourselves and our successors, heirs, administrators, executors, or personal representatives, as the case may be. This Performance Bond is provided to secure the performance of Principal in connection with a contract dated_____, 20___, between Principal and Owner for a project entitled _____ ("Project") – Public Works Project No. _____ ("Contract"). The initial penal sum shall equal 100 percent of the Total Bid Price, including all applicable state sales tax, as specified in the Proposal submitted by Principal.

NOW, THEREFORE, this Performance and Payment Bond shall be satisfied and released only upon the condition that Principal:

Faithfully performs all provisions of the Contract and changes authorized by Owner in the manner and within the time specified as may be extended under the Contract;

Pays all laborers, mechanics, subcontractors, lower tier subcontractors, material-persons, and all other persons or agents who supply labor, equipment, or materials to the Project;

Pays the taxes, increases and penalties incurred on the Project under Titles 50, 51 and 82 RCW on: (A) Projects referred to in RCW 60.28.011(1)(b); and/or (B) Projects for which the bond is conditioned on the payment of such taxes, increases and penalties; and

Posts a two-year warranty/maintenance bond to secure the project. Such bond shall be in the amount of twenty percent (20%) of the project costs.

Provided, further that this bond shall remain in full force and effect until released in writing by the City at the request of the Surety or Principal.

The surety shall indemnify, defend, and protect the Owner against any claim of direct or indirect loss resulting from the failure:

Of the Principal (or any of the employees, subcontractors, or lower tier subcontractors of the Principal) to faithfully perform the Contract, or

Of the Principal (or any subcontractor or lower tier subcontractor of the Principal) to pay all laborers, mechanics, subcontractors, lower tier subcontractors, material person, or any other person who provides supplies or provisions for carrying out the work.

The liability of Surety shall be limited to the penal sum of this Performance and Payment Bond.

No change, extension of time, alteration, or addition to the terms of the Contract or to the Work to be performed under the Contract shall in any way affect Surety's obligation on the Performance Bond. Surety hereby waives notice of any change, extension of time, alteration, or addition to the terms of the Contract or the Work, with the exception that Surety shall be notified if the Contract time is extended by more than twenty percent (20%).

If any modification or change increases the total amount to be paid under the Contract, Surety's obligation under this Performance and Payment Bond shall automatically increase in a like amount. Any such increase shall not exceed twenty-five percent (25%) of the original amount of the Performance and Payment Bond without the prior written consent of Surety.

This Performance and Payment Bond shall be governed and construed by the laws of the State of Washington, and venue shall be in Kitsap County, Washington.

IN WITNESS WHEREOF, the parties have executed this instrument in two (2) identical counterparts this _____ day of _____, 20 ___.

_____	_____
Principal	Surety
_____	_____
Signature of Authorized Official	Signature of Authorized Official
_____	By_____
Printed Name and Title	Attorney in Fact (Attach Power of Attorney)
Name and address of local office of Agent and/or Surety Company:	_____
	_____
	_____

Surety companies executing bonds must appear on the current Authorized Insurance List in the State of Washington on file with the Office of Insurance Commissioner.

ACKNOWLEDGEMENT
Corporation, Partnership, or Individual

STATE OF _____)
)ss.
COUNTY OF _____)

On this _____ day of_____, 20____, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared_____, to me known to be the (check one of the following boxes):

☐ _____ of _____, the corporation,

☐ _____ of _____, the partnership,

☐ individual,

that executed the foregoing instrument to be the free and voluntary act and deed of said ☐ corporation, ☐ partnership, ☐ individual for the uses and purposes therein mentioned, and on oath stated that ☐ he ☐she was authorized to execute said instrument.

WITNESS my hand and official seal hereto affixed the day and year first above written.

Notary Seal with Ink Stamp

_____
Print or type name

NOTARY PUBLIC,
in and for the State of Washington

Residing at _____

My Commission expires: _____

SURETY ACKNOWLEDGEMENT

STATE OF _____)
)ss.
COUNTY OF _____)

On this _____ day of_____, 20_____, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared_____, to me known to be the _____ of_____, the corporation that executed the foregoing instrument, and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that ☖ he ☖ she was authorized to execute said instrument.

WITNESS my hand and official seal hereto affixed the day and year first above written.

Notary Seal With Ink Stamp

_____
Print or type name

NOTARY PUBLIC,
in and for the State of Washington
Residing _____
My Commission expires: _____

CITY OF PORT ORCHARD
MAINTENANCE/WARRANTY BOND

NOTE: <u>This form must be completed at Contract Completion.</u> Before the Performance Bond or the retainage can be released, the City must receive the two year Maintenance /Warranty Bond

Project #:_____
Surety Bond #: _____
Date Posted: _____
Expiration Date:_____

RE: Project Name: _____
Owner/Developer/Contractor:_____
Project Address: _____

KNOW ALL PERSONS BY THESE PRESENTS: That we, _____ (hereinafter called the "Principal"), and _____, a corporation organized under the laws of the State of _____, and authorized to transact surety business in the State of Washington (hereinafter called the "Surety"), are held and firmly bound unto the City of Port Orchard, Washington, in the sum of _____ dollars ($_____) 20% of the total contract amount, lawful money of the United States of America, for the payment of which sum we and each of us bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, by these presents. THE CONDITIONS of the above obligation are such that:

WHEREAS, the above named Principal has constructed and installed certain improvements on public property in connection with a project as described above within the City of Port Orchard; and

WHEREAS, the Principal is required to post a bond for the twenty-four (24) months following written and final acceptance of the project in order to provide security for the obligation of the Principal to repair and/or replace said improvements against defects in workmanship, materials or installation during the twenty-four (24) months after written and final approval/acceptance of the same by the City;

NOW, THEREFORE, this Maintenance Bond has been secured and is hereby submitted to the City. It is understood and agreed that this obligation shall continue in effect until released in writing by the City, but only after the Principal has performed and satisfied the following conditions:

A. The work or improvements installed by the Principal and subject to the terms and conditions of this Bond are as follows: (insert complete description of work here)

B. The Principal and Surety agree that the work and improvements installed in the above-referenced project shall remain free from defects in material, workmanship and installation (or, in the case of landscaping, shall survive,) for a period of twenty-four (24) months after written and final acceptance of the same and approval by the City. Maintenance is defined as acts carried out to prevent a decline, lapse or cessation of the state of the project or improvements as accepted by the City during the twenty-four (24) month period after final and written acceptance, and includes, but is not limited to, repair or replacement of defective workmanship, materials or installations.

C. The Principal shall, at its sole cost and expense, carefully replace and/or repair any damage or defects in workmanship, materials or installation to the City-owned real property on which improvements have been installed and leave the same in as good condition or better as it was before commencement of the work.

D. The Principal and the Surety agree that in the event any of the improvements or restoration work installed or completed by the Principal as described herein, fail to remain free from defects in materials, workmanship or installation (or in the case of landscaping, fail to survive), for a period of twenty-four (24) months from the date of approval/acceptance of the work by the City, the Principal shall repair and/replace the same within ten (10) days of demand by the City, and if the Principal should fail to do so, then the Surety shall:

1. Within twenty (20) days of demand of the City, make written commitment to the City that it will either:

   a). remedy the default itself with reasonable diligence pursuant to a time schedule acceptable to the City; or

   b). tender to the City within an additional ten (10) days the amount necessary, as determined by the City, for the City to remedy the default, up to the total bond amount.

Upon completion of the Surety's duties under either of the options above, the Surety shall then have fulfilled its obligations under this bond. If the Surety elects to fulfill its obligation pursuant to the requirements of subsection D(1)(b), the City shall notify the Surety of the actual cost of the remedy, upon completion of the remedy. The City shall return, without interest, any overpayment made by the Surety, and the Surety shall pay to the City any actual costs which exceeded the City estimate, limited to the bond amount.

2. In the event the Principal fails to make repairs or provide maintenance within the time period requested by the City, then the City, its employees and agents shall have the right at the City's sole election to enter onto said property described above for the purpose of repairing or maintaining the improvements. This provision shall not be construed as creating an obligation on the part of the City or its representatives to repair or maintain such improvements.

E. Corrections. Any corrections required by the City shall be commenced within ten (10) days of notification by the City and completed within thirty (30) days of the date of notification. If the work is not performed in a timely manner, the City shall have the right, without recourse to legal action, to take such action under this bond as described in Section D above.

F. Extensions and Changes. No change, extension of time, alteration or addition to the work to be performed by the Principal shall affect the obligation of the Principal or Surety on this bond, unless the City specifically agrees, in writing, to such alteration, addition, extension or change. The Surety waives notice of any such change, extension, alteration or addition thereunder.

G. Enforcement. It is specifically agreed by and between the parties that in the event any legal action must be taken to enforce the provisions of this bond or to collect said bond, the prevailing party shall be entitled to collect its costs and reasonable attorney fees as a part of the reasonable costs of securing the obligation hereunder. In the event of settlement or resolution of these issues prior to the filing of any suit, the actual costs incurred by the City, including reasonable attorney fees, shall be considered a part of the obligation hereunder secured. Said costs and reasonable legal fees shall be recoverable by the prevailing party, not only from the proceeds of this bond, but also over and above said bond as a part of any recovery (including recovery on the bond) in any judicial proceeding. The Surety hereby agrees that this bond shall be governed by the laws of the State of Washington. Venue of any litigation arising out of this bond shall be in Kitsap County Superior Court.

H. Bond Expiration. This bond shall remain in full force and effect until the obligations secured hereby have been fully performed and until released in writing by the City at the request of the Surety or Principal.

DATED this ____ day of _____, 20__.

SURETY COMPANY
(Signature must be notarized)

By:_____
Its:_____

Business Name: _____

Business Address:_____

City/State/Zip Code: _____

Telephone Number: _____

DEVELOPER/OWNER
(Signature must be notarized)

By:_____
Its: _____

Business Name: _____

Business Address: _____

City/State/Zip Code: _____

Telephone Number: _____

CHECK FOR ATTACHED NOTARY SIGNATURE
_____Developer/Owner (Form P-1)
_____Surety Company (Form P-2)

FORM P-1 / NOTARY BLOCK

(Developer/Owner)

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 as the _____ of _____that (he/she) signed this instrument, on oath stated that (he/she) was authorized to execute the instrument and acknowledged it to be (his/her) free and voluntary act for the uses and purposes mentioned in the instrument.

Dated: _____

_____

_____

(print or type name)

NOTARY PUBLIC in and for the
State of Washington, residing
at: _____

My Commission expires: _____

FORM P-2/NOTARY BLOCK

(Surety Company)

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 as the _____ of _____that (he/she) signed this instrument, on oath stated that (he/she) was authorized to execute the instrument and acknowledged it to be (his/her) free and voluntary act for the uses and purposes mentioned in the instrument.

Dated: _____
_____

_____
(print or type name)

NOTARY PUBLIC in and for the
State of Washington, residing
at: _____
My Commission expires: _____

APPENDIX A

CITY HALL RENOVATIONS PROJECT

PROJECT MANUAL AND SPECIFICATIONS

APPENDIX B

VICINITY MAP

SECTION 011000 - GENERAL CONDITIONS

PART 1 GENERAL

1.1 PROJECT

A. Project Identification: Port Orchard City Hall - Building Improvements.
B. Project Site Address: 216 Prospect Street, Poulsbo, WA 98336.
C. Owner: City of Port Orchard.
D. Architect's Name: Rice Fergus Miller, Inc. (Hereafter referred to as the Architect)

1.2 CONTRACT DESCRIPTION

A. The Project will be constructed under a general construction Contract.
B. Contract Type: A single prime contract based on a Stipulated Sum as described in Port Orchard City Contract.

1.3 DESCRIPTION OF WORK

A. Detailed Project requirements are identified in the Contract Documents. For a general description of the Project and its Phases, refer to drawings.

1.4 DEFINITIONS

A. Working days: Working days are defined as Calendar days minus weekends and City holidays. For a full list of City holidays, see Section 011000.01 immediately following this section.

1.5 EQUIPMENT LIST / WORK BY OWNER / WORK BY OTHERS / EXISTING / N.I.C.

A. All work and materials shall be by Contractor unless noted otherwise in the Contract Documents.
B. Furniture & Equipment List: Refer to the equipment list for Contract responsibilities associated with project elements installed by Contractor that are provided by Owner and / or the Owner's Vendors. These items shall be coordinated with all parties that are under Separate Contract with the Owner.
    1. Any questions concerning the scope of work for any of these items shall be referred to the Architect prior to bid. No allowances will be allowed for missed scope of work.
    2. Owner's responsibility for OFCI items is limited to delivery of the systems (FOB) to the project site in coordination with the Contractor's Schedule and Sequence of Construction.
        a. Once OFCI items have been delivered to the Site, the Contractor is wholly responsible for their safety and installation.
        b. Refer to the Contract Documents associated with the appropriate trades for infrastructure and systems requirements including but not limited to plumbing, HVAC, conduit, boxes, hangers, and backing, etc. The Contractor shall provide plumbing, HVAC, backing, power and low voltage 'path', etc. as required and identified in the Contract Documents.
        c. The Contractor shall field verify the final locations of these items with the Owner prior to 'cover' during the Back Box Review including needs for backing and electrical and mechanical requirements, Refer to Section 013113 - Project Coordination.
C. Separate Contracts: Owner may award separate Contracts for performance of certain construction operations at the Project. Those operations shall be conducted simultaneously with work under this Contract in coordination with the Contractor.
D. Owner shall award a Separate Contract for Special Testing as required by the Authority Having Jurisdiction (AHJ).
    1. The Contractor shall provide the Owner's Representative with no less than three (3) working days notice in advance of the requirement for Special Testing.
E. Owner shall award a Separate Contract for the following:
    1. Signage not identified in the specifications or drawings.

F. Cooperate fully with Owner's vendors and equipment suppliers so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.6 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period. Work may require partial blockage of existing occupied corridors. Blocking of corridors shall be kept to the minimum necessary to complete the work and shall in no case reduce the corridor width to less than 48 inches clear.
B. Owner intends to occupy the Project upon Substantial Completion.
C. Contractor shall coordinate and schedule the work with Owner's staff to minimize conflicts and to facilitate Owner's operations.
D. Corridors shall be kept clean daily.
E. Schedule the Work shutdowns to accommodate Owner occupancy.

1.7 PROJECT COORDINATION, CONSTRUCTION LIMITS AND OWNER ACCESS

A. Owner's Representatives / Construction Manager / Construction Project Supervisor
   1. Chris Hammer. Tel: (360) 876-4991; E-mail: kchammer@portorchardwa.gov.
   2. Jeff Huffmyer; E-mail: jhuffmyer@portorchardwa.gov.
B. Cooperate with the Owner in allocation of mobilization areas of site for field offices and sheds, for access, traffic, and parking facilities.
   1. Comply with instructions from the Owner for use of temporary utilities and construction facilities.
   2. Contractor shall arrange for construction parking and delivery areas with the Owner and shall limit use of site to designated areas. Schedule delivery of materials and equipment to immediate construction working areas. Provide unobstructed access to Port Orchard City Hall areas required to remain in operation.
C. Construction Operations: Limited to areas noted on Drawings and as designated by Owner's Representatives.
D. Execute work so as to interfere as little as possible with normal functioning of Port Orchard City Hall as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, except as permitted by Owner where required by limited working space.
   1. Do not store materials and equipment in other than assigned areas.
E. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Owner. Provide unobstructed access to Port Orchard City Hall areas required to remain in operation.
F. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Work by Others.
   3. Work by Owner.
   4. Use of site and premises by the public.
G. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.
H. Time Restrictions:

1. Work taking place inside of the Port Orchard City Hall areas on the first floor must take place between 6:00 am and 4:00 PM and be scheduled through owner.
2. Limit conduct of especially noisy work to hours designated by Owner.

I. The Contractor will provide Fire Watch in the vicinity of Construction during construction hours during those periods when the fire alarm or suppression systems are impaired. The Contractor will provide documentation of such fire watches to the Owner.
   1. The Owner will be responsible for fire watch after construction hours.

J. Back Box Review and Coordination: The Owner shall coordinate an on-site 'back box review' with mechanical, electrical and plumbing subcontractors.
   1. Each Subcontractor shall field confirm rough-in locations for their respective trades, e.g. power, lighting, low voltage, equipment, plumbing, HVAC and equipment locations, etc. during rough-in and prior to cover.
   2. Relocation of rough-ins shall be provided at no charge.

K. Cleaning the interstitial space: Contractor shall vacuum all surfaces in the interstitial space in the Project Area prior to Close-out.

L. Temporary construction may be required; designed, engineered and constructed under General Contractor. Coordinate temporary construction such as infection control barriers with owner prior to erection.

M. Owner to have opportunity to inspect work prior to concealment of work. Notify Owner of date and time of inspections.

1.8 WORK SEQUENCE

A. Construct Work in phases during the construction period. Reference project document Drawing Sheets.

B. Coordinate construction schedule and operations with Owner.
   1. Submit the preliminary construction schedule at the Pre-Construction Conference for the Owner's review, record and approval.

C. A fire watch and fire extinguishers shall be provided.

1.9 CODES

A. Perform work in accordance with the requirements of the local jurisdictional code authorities. Applicable codes are listed on the Drawings, and in the individual Specifications Sections. Comply with codes in effect as of date of the Contract Documents.

B. Where differences exist between codes affecting this work, the code affording the greatest protection to the Owner shall govern.

C. If the Contractor observes that these drawings and specifications are at variance with the codes, the Contractor shall notify the Architect in writing at once.

1.10 AVAILABLE REFERENCE MATERIAL

A. Not Used

B. If material testing is required based on concerns of the contractor, the Owner will provide assurances that the area in question is free of contaminants or provide additional testing. If the additional test reports a negative condition for contaminants, the contractor will be responsible for the costs of the additional testing. If the additional testing is positive for contaminants the Owner will be responsible for the costs of the testing.

PART 1 PRODUCTS - NOT USED

PART 1 EXECUTION - NOT USED

END OF SECTION

City Observed Holidays

The following are generally recognized as holidays of the City:

2023

Day	Description
(observed) Monday, January 2	New Year's Day
Monday, January 16th	Martin Luther King Jr. Day
Monday, February 20th	President's Day
Monday, May 29th	Memorial Day
Monday, June 19	Juneteenth
Tuesday, July 4th	Independence Day
Monday, September 4th	Labor Day
Friday, November 10th	Veteran's Day
Thursday, November 23rd	Thanksgiving Day
Friday, November 24th	Day after Thanksgiving
Monday, December 25th	Christmas Day

Union members, please refer to your Collective Bargaining Agreement for your list of holidays.

2024

Day	Description
Monday, January 1st	New Year's Day
Monday, January 15th	Martin Luther King Jr. Day
Monday, February 19th	President's Day
Monday, May 27th	Memorial Day
Wednesday, June 19	Juneteenth
Thursday, July 4th	Independence Day
Monday, September 2nd	Labor Day
Monday, November 11th	Veteran's Day
Thursday, November 28th	Thanksgiving Day
Friday, November 29th	Day after Thanksgiving
Wednesday, December 26th	Christmas Day

2025

Day	Description
Wednesday, January 1st	New Year's Day
Monday, January 20th	Martin Luther King Jr. Day
Monday, February 17th	President's Day
Monday, May 26th	Memorial Day
Thursday, June 19	Juneteenth
Friday, July 4th	Independence Day
Monday, September 1st	Labor Day
Tuesday, November 11th	Veteran's Day
Thursday, November 27th	Thanksgiving Day
Friday, November 28th	Day after Thanksgiving
Thursday, December 25th	Christmas Day

Descriptions of holidays:

Union members, please refer to your Collective Bargaining Agreement for your list of holidays.

2026

Day	Description
January 1	New Year's Day
3rd Monday in January	Martin Luther King Jr. Day
3rd Monday in February	President's Day
Last Monday in May	Memorial Day
June 19	Juneteenth
July 4	Independence Day
1st Monday in September	Labor Day
November 11	Veteran's Day
4th Thursday in November	Thanksgiving Day
Friday after 4th Thursday in November	Day after Thanksgiving
December 25	Christmas Day

Any holiday falling on Saturday may be celebrated on the preceding Friday. Any holiday falling on Sunday may be celebrated on the following Monday. The City reserves the right to modify or rescind the foregoing holiday schedule, as it deems appropriate in its sole discretion, unless otherwise required by law or contract.

Union members, please refer to your Collective Bargaining Agreement for your list of holidays.

SECTION 011150 - DELEGATED DESIGN AND DEFERRED SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Delegated design components and systems.
B. Deferred submittal procedures

1.2 RELATED REQUIREMENTS

A. Drawing coversheet; list of Deferred Submittals.

1.3 DEFINITIONS

A. Applicant: Contractor applying for submittal approval by Architect, approved permit for Deferred Submittals, and coordinating Contractor Engineered Components with Project and with each other. Includes coordination of required submittals with Architect and the Authority Having Jurisdiction.
B. Architect: Architect registered in the State in which the Project is located and engaged by Owner to provide contract documents including drawings, computations and specifications required for building permit approval by Authority Having Jurisdiction for principal project systems. Includes Architect's staff, consultants and consultant's staffs.
C. Contractor: Firm engaged by Owner to construct Project. Includes employees, subcontractors, suppliers and their employees.
D. Contractor Design Engineer: Professional Engineer with 5 years documented experience in design of this work and licensed in the location of the Project and engaged by Contractor, subcontractor or supplier to provide drawings, computations and specifications required by Building Official for designated Contractor Engineered specialty system, in accordance with criteria set forth in Contract Documents.
E. Contractor Engineered Components are defined as complete systems provided for intended use.
F. "Delegated Design": The transfer of design and engineering responsibility from the Architect or Engineer of Record to the Contractor. The Contractor is responsible for the system from design to construction completion including engineering and permitting if required. Delegated Design components and systems submittals are reviewed by Designer of Record for compliance with design intent.
G. Seal: Certification that drawings, computations and specifications were designed and prepared under direct supervision of Architect or Engineer whose name appears thereon.
H. Review Stamp: Certification that Architect has reviewed drawings, computations and specifications bearing seal of Contractor Design Engineer, verifying conformance with information given and design concept set forth in Drawings and Specifications.
I. Approval Stamp: Certification that Building Official has reviewed submittal and finds it acceptable with respect to applicable code compliance.

1.4 SUBMITTALS

A. Show complete criteria, design assumptions, details, calculations, instructions for fabrications, assembly, installation and interface with other trades.
B. Contractor Design Engineer's stamp with calculations for that portion of work.
    1. Submittals without required calculations or Contractor Design Engineer's stamp and which have not been reviewed by Contractor will not be reviewed by Architect.

1.5 DELEGATED DESIGN COMPONENTS AND SYSTEMS

A. Components of Work and designated Delegated Design.
    1. Contractor is responsible to coordinate and assume complete responsibility for design, calculations, submittals, permits if required, fabrication, delivery and installation of Delegated Design Components and Systems.

2. If these Delegated Design systems are designated as a Deferred Submittal Contractor is responsible for submittal of documents to Authority Having Jurisdiction for review. Schedule Work so review will not adversely affect Project's construction schedule.
3. Architect's review of Delegated Design submittals is for general conformance with design intent as required by Authority Having Jurisdiction. Architect not responsible for coordination of Contractor Engineered Components with Contract Documents. Review does not lessen nor shift burden of responsibility from Contractor or assigned subcontractor/supplier to Owner or Architect.
4. Owner not responsible to pay for delays, additional products, hours of work or overtime, restocking or rework required due to failure to coordinate the Work with other trades or to provide Delegated Design and Deferred Submittal Components and their approval as required to meet project schedule.
5. Delegated Design Components and Systems: As scheduled below.

1.6 DEFERRED SUBMITTAL PROCEDURES

A. Components listed below are designated as a Deferred Submittal within the Authority Having Jurisdiction building permit approval process.
   1. Refer to Sheet A02.02 for list of deferred submittals.
B. Contractor shall serve as Applicant and submit for review and approval per Authority Having Jurisdiction requirements for all Deferred Submittals.
C. City of Port Orchard Bureau of Development Services has set policies regarding Delegated Design components of building projects. It is the responsibility of the Contractor to confirm the applicability of the following and to comply with all current requirements.
D. Components shall be coordinated with adjacent systems.
E. Authority Having Jurisdiction Submittals:
   1. Contractor Engineered Summary Sheet listing Contractor's Delegated Design engineer including registered engineer's name, address and telephone number.
   2. Design drawings and specifications clearly and legibly showing members, dimensions, connections, materials and indicating how component is attached to main structure.
      a. Prepare these documents stamped by Engineer licensed in the State in which the Project is located.
      b. Submit for Architect's signature indicating General Design Conformance.
      c. Shop drawings or erection drawing not acceptable for above requirements.
   3. Submit one set of calculations including criteria, design assumptions, substantiating computations and additional data sufficient to show correctness of drawings and compliance with structural revisions as indicated Structural Specialty Code.
      a. Prepare calculations stamped by Engineer who prepared calculations.
      b. Submit for Architect's signature indicating acceptance of design concepts, loading criteria and compatibility of designs.
F. Prior to start of work Deferred Submittals must be examined and approved by Authority Having Jurisdiction and returned to Owner.
G. Documents not completed prior to issuance of building permit, must be completed and submitted for approval prior to fabrication.
H. Contractor required to complete and submit

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 SCHEDULE OF DELEGATED DESIGN COMPONENTS AND SYSTEMS

A. Section: _____
B. Section: _____

END OF SECTION

SECTION 012200 - UNIT PRICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. List of unit prices, for use in preparing Bids.

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

C. Defect assessment and non-payment for rejected work.

1.2 RELATED REQUIREMENTS

A. Section 012900 - Payment Procedures: Additional payment and modification procedures.

1.3 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services, and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.4 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.5 MEASUREMENT OF QUANTITIES

A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

B. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect.

1. Measurement is made "in place", either prior to removal or after placement.

C. Measurement by Area: Measured by square dimension using mean length and width or radius.

D. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.

E. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes, calculate and certify quantities for payment purposes.

1.6 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

B. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected Products.

1.7 DEFECT ASSESSMENT

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

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct one of the following remedies:

1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Architect.
2. The defective Work will be partially repaired to the instructions of the Architect, and the unit price will be adjusted to a new unit price at the discretion of Architect.

C. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.
D. The authority of Architect to assess the defect and identify payment adjustment is final.

1.8 SCHEDULE OF UNIT PRICES

A. Material and labor for the removal of exterior sheathing and insulation. Installation of new insulation and exterior sheathing to match adjacent materials. The price is to be per square foot. Contractor to include 25% of the sheathing surface in their base bid. Unit pricing to be used for any scope above and beyond this 25%.
B. Item: _____; Section _____.
C. Item: _____; Section _____.
D. Item: _____; Section _____.
E. Item: _____; Section _____.
F. Item: _____; Section _____.
G. Item: _____; Section _____.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

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

1.3 DEFINITIONS

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

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

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 5 working days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 10 working days of receipt of request, or five working days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 10 working days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Requested substitution provides sustainable design characteristics that specified product provided.
      c. Substitution request is fully documented and properly submitted.
      d. Requested substitution will not adversely affect Contractor's construction schedule.
      e. Requested substitution has received necessary approvals of authorities having jurisdiction.
      f. Requested substitution is compatible with other portions of the Work.
      g. Requested substitution has been coordinated with other portions of the Work.
      h. Requested substitution provides specified warranty.

i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within 10 working days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
   a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   b. Requested substitution does not require extensive revisions to the Contract Documents.
   c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   d. Requested substitution provides sustainable design characteristics that specified product provided.
   e. Substitution request is fully documented and properly submitted.
   f. Requested substitution will not adversely affect Contractor's construction schedule.
   g. Requested substitution has received necessary approvals of authorities having jurisdiction.
   h. Requested substitution is compatible with other portions of the Work.
   i. Requested substitution has been coordinated with other portions of the Work.
   j. Requested substitution provides specified warranty.
   k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

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

1.3 MINOR CHANGES IN THE WORK

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

1.4 PROPOSAL REQUESTS

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

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 10 working days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or forms acceptable to Architect.

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

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or form acceptable to Architect.

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 012900 - PAYMENT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
   a. Application for Payment forms with continuation sheets.
   b. Submittal schedule.
   c. Items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Section 011000 "Summary."

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

1. Identification: Include the following Project identification on the schedule of values:
   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.

3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
        1) Labor.
        2) Materials.
        3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
    a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
10. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
11. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
C. Payment Application Times: Submit Application for Payment to Architect by the 5th of each month. Owner will make payment to the contractor in 30 calendar days. The period covered by each Application for Payment is one month, ending on the last day of the month.
    1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
E. Application for Payment Forms: Use forms provided by Owner for Applications for Payment. Sample copies are included in Project Manual.
F. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.
G. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
    1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
    2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
    3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
    4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
H. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
    1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
    2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
    3. Provide summary documentation for stored materials indicating the following:
        a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
        b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
        c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
I. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
    1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
J. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related

to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

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

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

L. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

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

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

N. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted

and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Notice of Completion of Public Works Contracts received from Public Works, L&I Contractor Release, and Employment Security Department.

O. No final payment shall be made until (a) the Contractor provides to the Owner, prior to the acceptance of the Work, a notarized Certification of Compliance in the form attached hereto as Exhibit A; (b) the Contractor provides to the Owner the Contractor's drawings showing as-built changes and field markings; (c) the Contractor provides to the Owner two copies of the Operating and Maintenance Manuals for equipment and/or systems installed by the Contractor, if applicable; (d) the Owner receives the Certificates of Payments Received by the Washington State Department of Revenue, Employment Security and Labor & Industries; and (e) current status of Contractor's Workers' Comp account is verified.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. Requests for Information (RFIs).
   4. Project Web site.
   5. Project meetings.

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

C. Related Requirements:
   1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
   4. Section 019100 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 5 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

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

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 REQUESTS FOR INFORMATION (RFIS)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

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

C. RFI Forms: AIA Document G716 Software-generated form with substantially the same content as indicated above, acceptable to Architect.
   1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 10 working days for Architect's response for each RFI. RFIs received by Architect after 3:00 p.m. will be considered as received the following working day.
   1. The following Contractor-generated RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for approval of Contractor's means and methods.
      d. Requests for coordination information already indicated in the Contract Documents.
      e. Requests for adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Architect's actions on submittals.
      g. Incomplete RFIs or inaccurately prepared RFIs.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at Owner Architect Contractor (OAC) Meeting or as requested by Owner or Architect. Use CSI Log Form 13.2B. Software log with not less than the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
   1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
   2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated. Due to Covid restrictions meetings will be conducted via digital tele video technology such as ZOOM.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
   1. Conduct the conference to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing of Owner furnished Items and long-lead items.
      d. Owner Furnished Contractor Installed Items
      e. Designation of key personnel and their duties.
      f. Lines of communications.
      g. Procedures for processing field decisions and Change Orders.
      h. Procedures for RFIs.
      i. Procedures for testing and inspecting.
      j. Procedures for processing Applications for Payment.
      k. Distribution of the Contract Documents.
      l. Submittal procedures.
      m. Preparation of record documents.
      n. Use of the premises.
      o. Work restrictions.
      p. Working hours.
      q. Owner's occupancy requirements.
      r. Responsibility for temporary facilities and controls.
      s. Procedures for moisture and mold control.
      t. Procedures for disruptions and shutdowns.
      u. Construction waste management and recycling.

v. Parking availability.
w. Office, work, and storage areas.
x. Equipment deliveries and priorities.
y. First aid.
z. Security.
aa. Progress cleaning.

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

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility requirements.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written instructions.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.
   v. Coordination with other work.
   w. Required performance results.
   x. Protection of adjacent work.
   y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 14 days prior to the scheduled date of Substantial Completion.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
      a. Preparation of record documents.
      b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
      c. Submittal of written warranties.
      d. Requirements for completing documentation.
      e. Requirements for preparing operations and maintenance data.
      f. Requirements for delivery of material samples, attic stock, and spare parts.
      g. Requirements for demonstration and training.
      h. Preparation of Contractor's punch list.
      i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
      j. Submittal procedures.
      k. Coordination of separate contracts.
      l. Owner's partial occupancy requirements.
      m. Installation of Owner's furniture, fixtures, and equipment.
      n. Responsibility for removing temporary facilities and controls.
   4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly intervals. All meetings to provide digital tele video capabilities if in-person attendance is not required.
   1. Coordinate dates of meetings with preparation of payment requests.
   2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         1) Review schedule for next period.
      b. Review present and future needs of each entity present, including the following:
         1) Interface requirements.

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

4. Minutes: General Contractor will be responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
   1. Attendees: In addition to representatives of Owner, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work. Architect shall be invited to the meeting as needed to facilitate coordination questions.
   2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
      c. Review present and future needs of each contractor present, including the following:
         1) Interface requirements.

2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Work hours.
11) Hazards and risks.
12) Progress cleaning.
13) Quality and work standards.
14) Change Orders.

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Startup construction schedule.
   2. Contractor's construction schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Material location reports.
   6. Site condition reports.
   7. Special reports.

B. Related Requirements:
   1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
   2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

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

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

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

F. Float: The measure of leeway in starting and completing an activity.
   1. Float time belongs to Owner.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

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

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF electronic file.
   3. Two paper copies.

B. Startup construction schedule.
   1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
D. Construction Schedule Updating Reports: Submit with Applications for Payment.
E. Daily Construction Reports: Submit at weekly intervals.
F. Material Location Reports: Submit at weekly intervals.
G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.5 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
      a. Insert list of major items or pieces of equipment.
   2. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
   3. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
   4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
   5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
C. Work Restrictions: Show the effect of the following items on the schedule:
   1. Coordination with existing construction.
   2. Limitations of continued occupancies.
   3. Uninterruptible services.
   4. Partial occupancy before Substantial Completion.
   5. Use of premises restrictions.
   6. Provisions for future construction.
   7. Seasonal variations.
   8. Environmental control.

D. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
E. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for commencement of the Work the Notice to Proceed the Notice of Award.
B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 30 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
    1. List of subcontractors at Project site.
    2. List of separate contractors at Project site.
    3. Approximate count of personnel at Project site.
    4. Equipment at Project site.
    5. Material deliveries.
    6. High and low temperatures and general weather conditions, including presence of rain or snow.
    7. Accidents.
    8. Meetings and significant decisions.
    9. Unusual events (see special reports).
    10. Stoppages, delays, shortages, and losses.
    11. Meter readings and similar recordings.
    12. Emergency procedures.
    13. Orders and requests of authorities having jurisdiction.
    14. Change Orders received and implemented.
    15. Construction Change Directives received and implemented.
    16. Services connected and disconnected.
    17. Equipment or system tests and startups.
    18. Partial completions and occupancies.
    19. Substantial Completions authorized.
B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
    1. Material stored prior to previous report and remaining in storage.
    2. Material stored prior to previous report and since removed from storage and installed.
    3. Material stored following previous report and remaining in storage.
C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for

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

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

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

PART 3 EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling: Contractor shall employ skilled personnel with experience in scheduling and reporting techniques to create the construction schedule.

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

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

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

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

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

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

1.3 DEFINITIONS

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

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

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

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

1.4 ACTION SUBMITTALS

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

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

4. Format: Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
    1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
        a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
        b. Digital Drawing Software Program: The Contract Drawings are available in pdf and AutoCAD.
        c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
        d. The following digital data files will by furnished for each appropriate discipline:
            1) Floor plans.
            2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
    1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
    2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
    3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
    4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
        a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
    1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
    2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
    3. Resubmittal Review: Allow 10 working days for review of each resubmittal.

4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 7 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
   4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
      a. Project name.
      b. Name and address of Architect.
      c. Name of Construction Manager.
      d. Name of Contractor.
      e. Name of firm or entity that prepared submittal.
      f. Names of subcontractor, manufacturer, and supplier.
      g. Category and type of submittal.
      h. Submittal purpose and description.
      i. Specification Section number and title.
      j. Specification paragraph number or drawing designation and generic name for each of multiple items.
      k. Drawing number and detail references, as appropriate.
      l. Location(s) where product is to be installed, as appropriate.
      m. Related physical samples submitted directly.
      n. Indication of full or partial submittal.
      o. Transmittal number, numbered consecutively.
      p. Submittal and transmittal distribution record.
      q. Other necessary identification.
      r. Remarks.
   5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
      a. Project name.
      b. Number and title of appropriate Specification Section.
      c. Manufacturer name.
      d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification

information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

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

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

PART 2 PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Contractor shall review and approve submittals prior to issuance to Architect. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Post electronic submittals as PDF electronic files directly to Architect's representative specifically established for Project.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   2. Submit electronic submittals via email as PDF electronic files.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
      b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.

c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. PDF electronic file.
   b. Three paper copies of Product Data unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.
   3. Submit Shop Drawings in the following format:
      a. PDF electronic file.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of applicable Specification Section.
      e. Specification paragraph number and generic name of each item.
   3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
   4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

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

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in the following format:
      a. PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

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

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

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

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

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

personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
    1. Name of evaluation organization.
    2. Date of evaluation.
    3. Time period when report is in effect.
    4. Product and manufacturers' names.
    5. Description of product.
    6. Test procedures and results.
    7. Limitations of use.
U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
    1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system

specifically assigned to Contractor to be designed or certified by a design professional.

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

C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.

1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

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

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

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

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

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

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope , consisting of multiple products, assemblies, and subassemblies.

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

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

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

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

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
    1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
    1. Indicate manufacturer and model number of individual components.
    2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
B. Qualification Data : For Contractor's quality-control personnel.
C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
    1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
    2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
    1. Specification Section number and title.
    2. Entity responsible for performing tests and inspections.
    3. Description of test and inspection.
    4. Identification of applicable standards.
    5. Identification of test and inspection methods.

6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

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

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
   1. Project quality-control manager may also serve as Project superintendent.

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

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
   1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
   2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
   3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.

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

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

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Photo Log:
1. Periodic Construction Photographs: Contractor is responsible for taking photographs twice weekly. Select vantage points to show status of construction and progress since last photographs were taken.

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

1.9 QUALITY ASSURANCE

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

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

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

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

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

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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

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

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
   a. Allow seven days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
   3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

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

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's

services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

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

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

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in Statement of Special Inspections attached to this Section, and as follows:

B. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections and in Statement of Special Inspections attached to this Section, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

A. To be determined by Owner prior to construction start

3.2 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

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

3.3 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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

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

END OF SECTION

SECTION 014200 - REFERENCES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

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

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

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.

2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
10. AF&PA - American Forest & Paper Association; www.afandpa.org.
11. AGA - American Gas Association; www.aga.org.
12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
14. AI - Asphalt Institute; www.asphaltinstitute.org.
15. AIA - American Institute of Architects (The); www.aia.org.
16. AISC - American Institute of Steel Construction; www.aisc.org.
17. AISI - American Iron and Steel Institute; www.steel.org.
18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
20. ANSI - American National Standards Institute; www.ansi.org.
21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
22. APA - APA - The Engineered Wood Association; www.apawood.org.
23. APA - Architectural Precast Association; www.archprecast.org.
24. API - American Petroleum Institute; www.api.org.
25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
26. ARI - American Refrigeration Institute; (See AHRI).
27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
28. ASCE - American Society of Civil Engineers; www.asce.org.
29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.

43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
47. BOCA - BOCA; (Building Officials and Code Administrators International Inc.); (See ICC).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; www.ec-central.org.
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FM Approvals - FM Approvals LLC; www.fmglobal.com.
80. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
81. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
82. FSA - Fluid Sealing Association; www.fluidsealing.com.
83. FSC - Forest Stewardship Council U.S.; www.fscus.org.
84. GA - Gypsum Association; www.gypsum.org.
85. GANA - Glass Association of North America; www.glasswebsite.com.
86. GS - Green Seal; www.greenseal.org.

87. HI - Hydraulic Institute; www.pumps.org.
88. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
89. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
90. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
91. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
92. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
93. IAS - International Approval Services; (See CSA).
94. ICBO - International Conference of Building Officials; (See ICC).
95. ICC - International Code Council; www.iccsafe.org.
96. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
97. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
98. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
99. IEC - International Electrotechnical Commission; www.iec.ch.
100. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
101. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
102. IESNA - Illuminating Engineering Society of North America; (See IES).
103. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
104. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
105. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
106. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
107. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
108. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
109. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
110. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
111. ISO - International Organization for Standardization; www.iso.org.
112. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
113. ITU - International Telecommunication Union; www.itu.int/home.
114. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
115. LMA - Laminating Materials Association; (See CPA).
116. LPI - Lightning Protection Institute; www.lightning.org.
117. MBMA - Metal Building Manufacturers Association; www.mbma.com.
118. MCA - Metal Construction Association; www.metalconstruction.org.
119. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
120. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
121. MHIA - Material Handling Industry of America; www.mhia.org.
122. MIA - Marble Institute of America; www.marble-institute.com.
123. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
124. MPI - Master Painters Institute; www.paintinfo.com.
125. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
126. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
127. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.

128. NADCA - National Air Duct Cleaners Association; www.nadca.com.
129. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
130. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
131. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
132. NCMA - National Concrete Masonry Association; www.ncma.org.
133. NEBB - National Environmental Balancing Bureau; www.nebb.org.
134. NECA - National Electrical Contractors Association; www.necanet.org.
135. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
136. NEMA - National Electrical Manufacturers Association; www.nema.org.
137. NETA - InterNational Electrical Testing Association; www.netaworld.org.
138. NFHS - National Federation of State High School Associations; www.nfhs.org.
139. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
140. NFPA - NFPA International; (See NFPA).
141. NFRC - National Fenestration Rating Council; www.nfrc.org.
142. NHLA - National Hardwood Lumber Association; www.nhla.com.
143. NLGA - National Lumber Grades Authority; www.nlga.org.
144. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
145. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
146. NRCA - National Roofing Contractors Association; www.nrca.net.
147. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
148. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
149. NSPE - National Society of Professional Engineers; www.nspe.org.
150. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
151. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
152. NWFA - National Wood Flooring Association; www.nwfa.org.
153. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
154. PDI - Plumbing & Drainage Institute; www.pdionline.org.
155. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
156. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
157. RFCI - Resilient Floor Covering Institute; www.rfci.com.
158. RIS - Redwood Inspection Service; www.redwoodinspection.com.
159. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
160. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
161. SDI - Steel Deck Institute; www.sdi.org.
162. SDI - Steel Door Institute; www.steeldoor.org.
163. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
164. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
165. SIA - Security Industry Association; www.siaonline.org.
166. SJI - Steel Joist Institute; www.steeljoist.org.
167. SMA - Screen Manufacturers Association; www.smainfo.org.
168. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
169. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
170. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
171. SPIB - Southern Pine Inspection Bureau; www.spib.org.
172. SPRI - Single Ply Roofing Industry; www.spri.org.

173. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
174. SSINA - Specialty Steel Industry of North America; www.ssina.com.
175. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
176. STI - Steel Tank Institute; www.steeltank.com.
177. SWI - Steel Window Institute; www.steelwindows.com.
178. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
179. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
180. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
181. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
182. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
183. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
184. TMS - The Masonry Society; www.masonrysociety.org.
185. TPI - Truss Plate Institute; www.tpinst.org.
186. TPI - Turfgrass Producers International; www.turfgrasssod.org.
187. TRI - Tile Roofing Institute; www.tileroofing.org.
188. UBC - Uniform Building Code; (See ICC).
189. UL - Underwriters Laboratories Inc.; www.ul.com.
190. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
191. USAV - USA Volleyball; www.usavolleyball.org.
192. USGBC - U.S. Green Building Council; www.usgbc.org.
193. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
194. WASTEC - Waste Equipment Technology Association; www.wastec.org.
195. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
196. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
197. WDMA - Window & Door Manufacturers Association; www.wdma.com.
198. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
199. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
200. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
201. WPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
   1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
   2. ICC - International Code Council; www.iccsafe.org.
   3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.
   1. COE - Army Corps of Engineers; www.usace.army.mil.
   2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
   3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
   4. DOD - Department of Defense; http://dodssp.daps.dla.mil.

5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; http://eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
   2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.
   3. DSCC - Defense Supply Center Columbus; (See FS).
   4. FED-STD - Federal Standard; (See FS).
   5. FS - Federal Specification; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.
      a. Available from Defense Standardization Program; www.dsp.dla.mil.
      b. Available from General Services Administration; www.gsa.gov.
      c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
   6. MILSPEC - Military Specification and Standards; (See DOD).
   7. USAB - United States Access Board; www.access-board.gov.
   8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. CBHF - State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
   2. CCR - California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
   3. CDHS - California Department of Health Services; (See CDPH).

4. CDPH - California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC - California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD - South Coast Air Quality Management District; www.aqmd.gov.
7. TFS - Texas Forest Service; Forest Resource Development and Sustainable Forestry; http://txforestservice.tamu.edu.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 321216 "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
3. Section 321313 "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

G. Sewer, Water, and Electric Power Service: Use charges are specified in Section 011200 "Multiple Contract Summary."

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

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

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

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

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

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

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

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

PART 2 PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
    1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
    2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
    3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".
C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
    1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
    1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
    1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Coordinate with Owner for location of temporary facilities.
F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
    1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
        a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
        b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

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

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Install electric power service underground unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

A. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

B. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

C. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
a. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

D. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

G. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
1. Do not load elevators beyond their rated weight capacity.

2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

H. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."

D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

E. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

F. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
1. Construct covered walkways using scaffold or shoring framing.
2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

H. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
1. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
2. Protect air-handling equipment.
3. Provide walk-off mats at each entrance through temporary partition.

I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.
   4. Remove standing water from decks.
   5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   2. Keep interior spaces reasonably clean and protected from water damage.
   3. Periodically collect and remove waste containing cellulose or other organic matter.
   4. Discard or replace water-damaged material.
   5. Do not install material that is wet.
   6. Discard, replace, or clean stored or installed material that begins to grow mold.
   7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use permanent HVAC system to control humidity.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
      a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
      b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
      c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
B. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
    1. Materials and facilities that constitute temporary facilities are property of Contractor.
    2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.
2. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

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

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

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 5 working days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 10 working days of receipt of request, or 5 working days of receipt of additional information or documentation, whichever is later.
    a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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

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

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

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

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 017300 - EXECUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.

B. Related Requirements:
   1. Section 011000 "Summary" for limits on use of Project site.
   2. Section 013300 "Submittal Procedures" for submitting surveys.
   3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
   4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
   5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

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

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

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Contractor is required to allow Owner to inspect all walls, ceilings, all finished spaces and all elements therein to validate the quality of the work and the presence and location of all required elements in the walls, ceilings and all finished spaces.
   2. Concealed Elements: Contractor is required to allow Owner to inspect all work before it is concealed.
   3. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
   4. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

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

5. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain-wall construction.
   d. Sprayed fire-resistive material.
   e. Equipment supports.
   f. Piping, ductwork, vessels, and equipment.
   g. Noise- and vibration-control elements and systems.
6. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

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

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.1 EXAMINATION

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

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

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Owner will have the option to inspect all walls before Gypsum board is applied.
3. No existing and abandoned items (i.e. plumbing lines, gas lines, electrical conduit) will be left in place. All existing items will be removed and disposed of.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
6. Owner will examine all concealed spaces before wall face or ceilings are installed. Contractor will let owner know in weekly construction meetings when concealed spaces will be available for inspection.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

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

3.2 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

B. Storage of all construction tools and materials will be maintained in/on locations that have been approved by owner prior to commencement of construction activities.
C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.
F. Contractor will secure and lock all supplies and tools at the end of each day in the designated contractor laydown areas. Owner is not responsible for tools or supplies that go missing. No tools or supplies will be left in the construction area without prior owner approval.

3.4 HOURS OF WORK

1. Work taking place inside of the Existing Emergency Department or adjacent areas on the first floor must take place between 6:00 am and 4:00 PM and be scheduled through owner.
2. Limit conduct of especially noisy work to hours designated by Owner.
3. Construction in the basement must first be coordinated with the owner. In essence the rooms will need to be scheduled through owner for construction activity. Contractor should anticipate at least one weeks' notice to schedule rooms.

3.5 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.
B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
    1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
    2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
    1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
    2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
    3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
    1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours,

and the distance and bearing from a site corner to a legal point.

2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.6 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

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

C. NVH Permits. A standing “Hot Works Permit” will be permitted to the contractor for work inside the construction zone. Any work outside the construction zone, i.e., inside the existing hospital, will require Hot Works Permit for each instance of that work and any time the contractor works above the ceiling in the existing facility, they will be required to take out an Above-Ceiling Work Permit. These are secured through the Facilities office.

D. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

E. 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.

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

G. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

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

I. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

J. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

K. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.7 CUTTING AND PATCHING

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

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

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

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

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

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

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

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

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

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

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and

appearance.

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

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

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

3.8 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.
B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.9 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
a. Use containers intended for holding waste materials of type to be stored.
4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
B. Site: Maintain Project site free of waste materials and debris.
C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.10 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.11 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
   1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements.
   2. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Consult with Owner regarding Salvaging, recycling and disposal of construction and demolition waste. Wherever possible recycle construction and/or demolition waste.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management process as agreed with Owner. plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
B. Salvaged Items for Sale and Donation: Are not permitted on Project site. Owner will have first right of refusal on all salvaged waste material. Salvaged waste cannot be stored on site.
C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.
D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
F. Plumbing Fixtures: Separate by type and size.
G. Lighting Fixtures: Separate lamps by type and protect from breakage.
H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   3. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction. No construction waste can be sold or given away on the project site.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

B. Related Requirements:
   1. Section 017300 "Execution" for progress cleaning of Project site.
   2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

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

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

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

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

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
   3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Contractor shall submit all prevailing wage affidavits for the history of the project.
3. Contractor shall submit to owner a set of record drawings not all changes from design that were incorporated during construction.
4. Contractor shall submit to Owner lien releases for general contractor and all sub-contractors.

5. Before final payment can be released, Washington State Labor and Industries, Washington Department of Revenue and Washington State Employment Security, must have released contractor from its respective responsibilities.
6. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
7. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
8. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.
   1. Organize list of spaces in sequential order,.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Name of Architect.
      c. Name of Contractor.
      d. Page number.
   4. Submit list of incomplete items in the following format:
      a. MS Excel electronic file. Architect will return annotated file.
      b. PDF electronic file. Architect will return annotated file.
      c. Three paper copies. Architect will return two copies.

1.9 SUBMITTAL OF PROJECT WARRANTIES

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

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

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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

PART 2 PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
   1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 EXECUTION

3.1 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      h. Sweep concrete floors broom clean in unoccupied spaces.
      i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
      j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
      k. Remove labels that are not permanent.

l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

B. Related Requirements:
   1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Section 019000 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

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

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

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Owner will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.
   2. Two paper copies to Owner. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Owner will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
   1. Correct or revise each manual to comply with comments. Submit copies of each corrected manual within 15 days of receipt of comments and prior to commencing demonstration and training.

PART 2 PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

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

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

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

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

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

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

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

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Flood.
2. Gas leak.
3. Water leak.
4. Power failure.
5. Water outage.

6. System, subsystem, or equipment failure.
7. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.
10. Training procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
C. Product Information: Include the following, as applicable:
    1. Product name and model number.
    2. Manufacturer's name.
    3. Color, pattern, and texture.
    4. Material and chemical composition.
    5. Reordering information for specially manufactured products.
D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
    1. Inspection procedures.
    2. Types of cleaning agents to be used and methods of cleaning.
    3. List of cleaning agents and methods of cleaning detrimental to product.
    4. Schedule for routine cleaning and maintenance.
    5. Repair instructions.
E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
    1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
    1. Standard maintenance instructions and bulletins.
    2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
    3. Identification and nomenclature of parts and components.
    4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.
E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Requirements:
   1. Section 017300 "Execution" for final property survey.
   2. Section 017700 "Closeout Procedures" for general closeout procedures.
   3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set(s) of marked-up record prints.
   2. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints and one of file prints.
         2) Submit record digital data files and one set(s) of plots. DWG/CAD compatible.
         3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit one paper-copy set of marked-up record prints.
         2) Submit PDF electronic files of scanned record prints and three set(s) of prints.
         3) Print each drawing, whether or not changes and additional information were recorded.
         4) Submit record digital data files and three set(s) of record digital data file plots. DWG/CAD Compatible.

B. Record Specifications: Submit one paper copy annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding archive photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or Construction Change Directive.
      k. Changes made following Architect's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.
      n. Record information on the Work that is shown only schematically.
   3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
   4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   5. Mark important additional information that was either shown schematically or omitted from original Drawings.
   6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
   1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
   2. Format: DWG, Version , Microsoft Windows operating system.
   3. Format: Annotated PDF electronic file.
   4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
   5. Refer instances of uncertainty to Architect for resolution.
   6. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
a. Project name.
b. Designation "PROJECT RECORD DRAWINGS."
c. Name of Architect.
d. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file paper copy.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file paper copy.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
B. Format: Submit miscellaneous record submittals as PDF electronic file paper copy.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.
2. Documentation: Review the following items in detail:
    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.

l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
   2. Owner will furnish an instructor to describe Owner's operational philosophy.
   3. Owner will furnish Contractor with names and positions of participants.
C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Delegated design of components or supports requiring structural engineering before, during, or after demolition; or any engineering for cutting into structural assemblies.
B. Selective demolition of building elements.
C. Utility Services and Mechanical/Electrical System.
D. Salvaged and removal of building elements.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013100 - Project Management and Coordination.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.
   2. Review Owner salvage requirements and conduct a walk-through with Owner present.

1.3 SUBMITTALS

A. Qualification Data: For demolition contractor listing projects and references.
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. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of partitions, barricades and fences.
   2. Include procedures and coordination with other work in progress, a disconnection schedule of utility services, and a detailed description of methods and equipment to be used for each operation and of the sequence of operations.
   3. Identify demolition firm and submit qualifications.
   4. Include a summary of safety procedures.
D. Engineering Survey.
E. Existing Condition Survey.
F. Shop Drawings: extents of demolition, locations of existing utilities, and locations of utility capping. Indicate structural members and elements that will be demolished. .
G. Closeout Submittals: Accurately record actual locations of capped and active utilities and subsurface construction.

1.4 QUALITY ASSURANCE

A. Demolition Contractor Qualifications: Company specializing in selective demolition comparable in scope, environmental and historical sensitivity 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.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Selectively demolish existing elements to accommodate tie-in of new work to existing conditions.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. 29 CFR 1910: Occupational Safety and Health Standards.
B. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
C. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

D. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
E. Storage or sale of removed items or materials on-site is not permitted.
F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
    1. Maintain fire-protection facilities in service during selective demolition operations.
G. Comply with governing EPA notification regulations before beginning selective demolition.
H. Comply with hauling and disposal regulations of authorities having jurisdiction.

2.3 MATERIALS

A. Materials as required for delegated design of temporary shoring.

2.4 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before start of work.
B. Review record documents provided by Owner and schedule listing salvage and remove for reuse items.
C. Engage a professional engineer to perform an engineering survey to determine if removing indicated elements may result in a structural deficiency or unsafe condition during scope of work.
D. Perform a survey of existing conditions by use of measured drawings and preconstruction photographs.
E. It is not expected that hazardous materials will be encountered in the Work.
    1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

3.2 PREPARATION

A. Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
B. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
C. Provide fire watch during hot work while sprinklers are offline.

3.3 SELECTIVE DEMOLITION OF BUILDING ELEMENTS

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations.
B. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.
D. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

3.4 SALVAGE AND REMOVAL OF BUILDING ELEMENTS

A. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

C. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

D. Maintain fire watch during and for at least two hours after flame-cutting operations.

E. Dispose of demolished items and materials promptly.

3.5 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition. Return adjacent areas to condition existing before selective demolition rations began.

B. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Dispose of all waste material in accordance with project's Waste Management Plan.
1. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.6 PROTECTION

A. Remove temporary barricades and protections where hazards no longer exist.

3.7 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove the fire suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Equipment to be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.8 SCHEDULE

A. Locations and extent in accordance with demolition drawings.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Form-facing materials.
B. Steel reinforcement.
C. Reinforcement accessories.
D. Concrete materials.
E. Waterstops.
F. Vapor retarders.
G. Floor and slab treatments.
H. Liquid floor treatments.
I. Curing materials.
J. Related materials.
K. Repair materials.
L. Concrete mixtures, general.
M. Concrete mixtures for building elements.
N. Fabricating reinforcement.
O. Concrete mixing.

1.2 RELATED REQUIREMENTS

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
    1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
        a. Contractor's superintendent.
        b. Independent testing agency responsible for concrete design mixtures.
        c. Ready-mix concrete manufacturer.
        d. Concrete Subcontractor.
        e. Special concrete finish Subcontractor.
    2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
    1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Shop drawings shall be produced by the Contractor or Contractor's Subcontractor and shall not include any direct reproductions of the Structural Drawings or Structural CAD.
D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.
E. Samples: For waterstops and vapor retarder.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.
B. Welding certificates.
C. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Fiber reinforcement.
   6. Waterstops.
   7. Curing compounds.
   8. Floor and slab treatments.
   9. Bonding agents.
   10. Adhesives.
   11. Vapor retarders.
   12. Semirigid joint filler.
   13. Joint-filler strips.
   14. Repair materials.
D. Material Test Reports: For the following, from a qualified testing agency:
   1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
F. Field quality-control reports.
G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D1.4M.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

2.1 CONCRETE, GENERAL

A. Comply with the specifications and codes noted in the Structural Drawings for all Structural Concrete.

B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. High-density overlay, Class 1 or better.
   b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   c. Structural 1, B-B or better; mill oiled and edge sealed.
   d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

3. Overlaid Finish birch plywood.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Refer to the Structural Notes in the Structural Drawings.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, ASTM A775/A775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.

D. Zinc Repair Material: ASTM A780/A780M.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. See Structural Drawings for material requirements for structural concrete. Where Structural Notes disagree with these Specification, the Structural Notes shall prevail.
C. Cementitious Materials:
   1. Portland Cement: ASTM C150/C150M. Refer to the Structural Drawings for cement type.
   2. Fly Ash: ASTM C618, Class F
D. Normal-Weight Aggregates: ASTM C33/C33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
E. Air-Entraining Admixture: ASTM C260/C260M.
F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
G. Water: ASTM C94/C94M.

2.6 WATERSTOPS

A. Bentonite Rope Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes. Basis of Design Product: RX 101 and 102 by Cetco.
   1. Dimensions: as recommended for wall depth; nontapered.

2.7 VAPOR RETARDERS

2.8 FLOOR AND SLAB TREATMENTS

2.9 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.10 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. See Structural General Notes for applications.
B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
D. Water: Potable.
E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating. See Structural General Notes for application.
F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering. See Structural General Notes for application.

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D2240.
C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
D. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
    1. Types I and II, nonload-bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
E. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
    1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
    2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
    3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
    4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109/C109M.
B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
    1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
    2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
    3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
    4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109/C109M.

2.13 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
    1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
B. Refer to the Structural Notes for mix design requirements for Structural Concrete. Where Structural Notes disagree with these Specifications, the Structural Notes shall prevail.
C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
    1. Fly Ash: 15 percent.
D. Limit water-soluble, chloride-ion content in hardened concrete to 0.06

E. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. See Structural General Notes for requirements

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to

prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. All embedments shall be tied in place prior to concrete placement. "Wet-setting" shall not be permitted.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
4. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
    1. Weld reinforcing bars according to AWS D1.4/D1.4M, where indicated.
D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
    1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
    2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
    3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection. Provide joint layout on slabs as indicated on Structural and Architectural Plans, and Structural General Notes.
    4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
    5. Space vertical joints in walls as indicated Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
    6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
    7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
    1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
    2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
    1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
    2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079005 - Joint

Sealers, are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

1. Any site added water shall be indicated in the mix design and shall be documented for review by the Architect.
2. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.
B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
   3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
   1. Apply scratch finish to surfaces indicated, to receive concrete floor toppings, and to receive mortar setting beds for bonded cementitious floor finishes.
C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated, to receive trowel finish, and to be covered with fluid-applied or sheet waterproofing, built up or membrane roofing, or sand-bed terrazzo.
D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of

trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated, exposed to view, or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E1155 (ASTM E1155M), for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
    b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
    d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
    1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
    1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
C. Equipment Bases and Foundations:
    1. Coordinate sizes and locations of concrete bases with actual equipment provided.
    2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
    3. Minimum Compressive Strength: 4000 psi at 28 days.
    4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
    5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
    6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of

coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's

written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
C. Inspections (See Structural General Notes for additional requirements):
    1. Steel reinforcement placement.
    2. Steel reinforcement welding.
    3. Headed bolts and studs.
    4. Verification of use of required design mixture.
    5. Concrete placement, including conveying and depositing.
    6. Curing procedures and maintenance of curing temperature.
    7. Verification of concrete strength before removal of shores and forms from beams and slabs.
D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
    1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
        a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
    3. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
    4. Air Content: ASTM C231/C231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31/C31M.
    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractoror's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E1155 (ASTM E1155M) within 24 hours of finishing.

END OF SECTION

SECTION 040120 - MASONRY CLEANING AND REPAIR

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Repointing joints with mortar.
- B. Repair and Replacement of damaged masonry.
- C. Cleaning existing masonry.

1.2 DEFINITIONS
- A. Low Pressure Spray: 100 to 400 psi at 4-6 gallons per minute

1.3 ALLOWANCE
- A. Assume 10 percent cosmetic tuckpointing of existing facade.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013100 - Project Management and Coordination.
  1. Review methods and procedures related to treatment of masonry including, but not limited to, the following:
     a. Treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
     b. Materials, material application, sequencing, tolerances, and required clearances.
     c. Masonry treatment program.

1.5 SUBMITTALS
- A. Product Data: Include recommendations for product application and use.
- B. Shop Drawings:
  1. Include plans, elevations, and sections showing locations and extent of repair and replacement work.
- C. Samples:
  1. Facing Brick of replacement masonry units.
  2. Mortar for tuckpointing.
- D. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
- 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.
  3. Recommended schedule of maintenance.

1.6 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.

PART 2 PRODUCTS

2.1 DESCRIPTION
- A. Protect materials to the greatest extent possible. The gentlest means shall be used to perform the work and the greatest care shall be taken to ensure that the materials are not damaged in the process of work in this section.

2.2 CLEANING EXISTING MASONRY
- A. Process to be approved by Treatment Specialist:
  1. Non-ionic detergent: Prosoco SureKlean.
  2. Soft bristle brush.
  3. Low PSI (under 60).

2.3 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.
B. Protect adjacent materials from damage by masonry treatment.
C. Approval of test patch of existing masonry repointing.
D. Approval of test patch of existing masonry cleaning.

3.3 MASONRY REPOINTING, GENERAL

A. Appearance Standard: Repointed surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.

3.4 WIDENING JOINTS

A. Do not widen a joint, except where indicated or approved by Architect.
B. Location Guideline: Where an existing masonry unit abuts another or the joint is less than 1/8 inch, widen the joint for length indicated and to depth required for repointing after obtaining Architect's approval.
C. Carefully perform widening by using cutting, grinding, routing, or filing procedures demonstrated in an approved mockup.
D. Widen joint to width equal to or less than predominant width of other joints on building. Make sides of widened joint uniform and parallel. Ensure that edges of units along widened joint are in alignment with joint edges at unaltered joints.

3.5 REPOINTING MASONRY

A. Joints to be hand-raked, no sawcutting.
B. Rake out joints as follows, according to procedures demonstrated in approved mockup:
    1. Remove mortar from joints to depth of joint width plus 1/8 inch (3 mm), but not less than 1/2 inch (13 mm) or not less than that required to expose sound, unweathered mortar. Do not remove unsound mortar more than 2 inches (50 mm) deep; consult Architect for direction.
    2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
    3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
        a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Architect's written approval based on approved quality-control program.
C. Notify Architect of unforeseen detrimental conditions, including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
D. Pointing with Mortar:
    1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
    2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch (9 mm) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch (9 mm). Fully compact each layer and allow it to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
    a. First two subparagraphs below may be deleted for mortars with high Portland cement content.
    b. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
    c. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Remove mortar and repoint.

E. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.6 FIELD QUALITY CONTROL

A. Manufacturers Field Service: Engage masonry repair material manufacturers' factory-authorized service representatives for consultation and project site inspection, and provide on-site assistance when requested by Architect.

3.7 CLEANING

A. Clean exposed surfaces immediately after masonry repair. Avoid damage to coatings and finishes. Remove excess sealants, patching materials, dirt, and other substances.
B. Dispose of all waste material in accordance with project's Waste Management Plan.
    1. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.8 CLEANING EXISTING MASONRY

A. Use cleaner in accordance with manufacturer's instructions and guidance from Treatment Specialist.

3.9 PROTECTION

A. Protect surfaces from contact with contaminating substances resulting from construction operations. Monitor wood surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact wood surfaces, remove contaminants immediately.

3.10 SCHEDULE

A. Masonry to repair:
    1. Damaged units beyond repair.
B. Mortar Use
    1. Masonry mortar for replacement bricks: To match existing in strength, texture, and color.
    2. Masonry grout for tuckpointing: To match existing in strength, texture, and color.

END OF SECTION

SECTION 042000 - UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Facing Brick.
B. Installation Materials.

1.2 RELATED REQUIREMENTS

A. 072100 - Thermal Insulation: For insulation components of masonry systems.
B. 072500 - Weather Barriers: For components of masonry systems.
C. 076200 - Sheet Metal Flashing and Trim: For sheet metal components of masonry systems.
D. 079005 - Joint Sealers.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013100 - Project Management and Coordination.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.4 SUBMITTALS

A. Qualification Data: For manufacturer, fabricator, and installer.
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: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.
   1. Include material properties and test reports substantiating compliance with project requirements.
   2. Size Variation Data: For brick or block.
   3. Efflorescence Rating: In accordance with ASTM C67: For exposed brick.
   4. Durability: In accordance with ASTM C67; 50 cycles of freezing and thawing.
   5. Strength: provide data and calculations establishing average net-area compressive strength for masonry units used in structural assemblies.
   6. Steel reinforcing bars.
   7. Joint reinforcement.
   8. Anchors, ties, and metal accessories.
   9. Cementitious Materials include:
      a. Brand, type, and name of manufacturer.
      b. Description of mix design and proportions of ingredients.
D. Shop Drawings: Indicate required flashings, control joints, and expansion joints, sealing at openings, projections, and penetrations.
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
   3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
   4. Detail Drawings: Submit elevation or overall drawings at 1/2 inch equal to 1 foot scale and detail drawings of a minimum 1-1/2 inch equal to 1 foot scale showing:
      a. Bar splice locations.
      b. Wall elevations exposed to view indicating the location of all cut masonry products.
      c. Location and diagrams of all bent bars.
      d. Wall dimensions, bar clearances, and all openings greater than one masonry unit in area.

e. Control joints.

E. Samples: Full units to illustrate range of color and texture.
1. Facing Brick.

F. Certificate: When using bricks containing contaminated soil: Certification by manufacturer that the hazardous waste is neutralized by the manufacturing process and that no additional pollutants will be released.

G. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods for cementitious materials and accessories.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

I. 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.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualification: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.

B. Fabricators Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum of 5 years of experience.
1. Certified member in good standing with the Washington State Conference of Mason Contractors (WSCMC) or Mason Contractors Association of Oregon (MCAO).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle material to avoid chipping, breakage, and contact with soil or contaminating materials.

B. Do not ship facing units to site until Architect approves sample panel.

C. Store masonry units in accordance with ASTM C90.

D. Store moisture sensitive materials in dry, weathertight enclosures.

1.7 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.

1.8 ENVIRONMENTAL CONDITIONS

A. General: Conform to ASTM D1790 for hot and cold weather masonry construction.

B. Hot Weather:
1. Take the following precautions if masonry is erected when:
a. The ambient air temperature is more than 99 degrees F. (37 degrees C.) in the shade and the relative humidity is less than 50 percent.
b. The ambient air temperature exceeds 90 degrees F. (30 degrees C.) and the wind velocity is more than 8 mph (13 km).
2. Shade masonry materials from direct sunlight; spread mortar beds no more than 4 feet ahead of masonry; set masonry units within one minute of spreading mortar; and after erection, protect masonry from direct exposure to wind and sun for 48 hours.

C. Cold Weather:
1. Take the following precautions if masonry is erected when:
a. Ambient temperature or mean daily air temperature falls below 40 degrees F. (4 degrees C.)

b. Temperature of masonry units is below 40 degrees F. (4 degrees C.)
2. Provide supplemental heat to achieve required ambient temperature of air and materials.

PART 2 PRODUCTS

2.1 DESCRIPTION
A. Exterior assemblies of clay masonry units including facing brick and installation materials.

2.2 PERFORMANCE AND DESIGN CRITERIA
A. Blend brick to produce a uniform appearance when installed and avoid an observable banding or layering of colors or textures.
B. Follow details and specifications for size, layout, and grouting of structural unit masonry walls. Coordinate net-area compressive strength requirements with Architect.
1. Determine net-area compressive strength as follows:
a. Unit Strength Method: Compressive strength of units and mortar per Tables 1 and 2 in ASTM D1790 / ASTM C1405 / TMS 402/602.
b. Prism Method: Test masonry prisms in accordance with ASTM C1314.

2.3 GENERAL
A. Obtain masonry units from a single manufacturer for each type of unit used.
B. Obtain Cementious materials from a single manufacturer for each type used.

2.4 FACING BRICK
A. Manufacturer: Match existing brick veneer on building.
B. Complying with ASTM C216.
C. Manufacture bricks from locally mined clay or shale and extruded into molds, pre-warmed and kiln-dried for a minimum of 40 hours.
D. Unit Sizes: Match existing brick veneer on building.
E. Grade: SW (severe weathering)
F. Type: FBX
G. Minimum Compressive Strength:
1. Average of 5 units: 3000 psi.
2. Individual unit: 2500 psi.
H. Dimensional Tolerances: Per ACI 530/530.1.
I. Core Holes: Holes in solid bricks not more than 25 percent of total bedding surface.

2.5 CEMENTITIOUS MATERIALS
A. Portland Cement: Complying with ASTM C150/C150M.
B. Masonry Cement: Complying with ASTM C91/C91M.
C. Sand: Complying with ASTM C144.
D. Water: Clean, potable, and free from substances which could adversely affect the mortar.
E. Fly Ash: Complying with ASTM C641, Class F.
1. Cement-lime mortar: 40 percent maximum with type IP cement.
F. Mortar Coloring: Colorant specifically made for use in masonry mortar.
1. Added to the mortar used for exposed masonry surfaces to produce a uniform color.
2. Quantity of pigment required to match approved samples.
3. Color: Match existing mortar on building.
G. Cold Weather Accelerating Admixture: Complying with ASTM C494/C494M non-corrosive, containing less than 0.2 percent chlorides.
H. Masonry Mortar: Complying with ASTM C270.
1. Mortar Types: Conform to the proportion specification of ASTM C270.
a. Type M cement-lime mortar: 1 part cement, 1/4 part lime, and 3-3/4 parts aggregate.
1) Average compressive strength at 28 days: Not be less than 2500 psi.
b. Type S cement-lime mortar: 1 part cement, 1/2 part lime, and 4-1/2 parts aggregate.

c. Type N cement-lime mortar: 1 part cement, 1 part lime, and 6 parts aggregate.

2. Air-Content: When structural reinforcement is incorporated.
   a. Cement-lime mortar: 12 percent maximum.
   b. Masonry cement mortar: 18 percent maximum.
3. Admixture: Liquid, integral water-repellent, bond-enhancing admixture for masonry mortar.
   a. Basis of Design: DRY-BLOCK Mortar Admixture by GCP Applied Technologies.

I. Grout:
1. General: Comply with ASTM C476, with minimum compressive strength of 2,000 psi when tested in accordance with ASTM C1019.
   a. Slump: 8 to 10 inches as measured by ASTM C143/C143M.
   b. Grout Mix: Provide factory-blended hydraulic cement-based products containing the following minimum components:
      1) Portland cement or blended cement: ASTM C150/C150M Types I, IA, II, IIA, III or IIIA.
      2) Portland Cement or Blended Cement: ASTM C593 Types IS, IS(MS), IS-A, IS-A(MS), IP, or IP-A.
      3) Portland cement or Blended Cement: ASTM C595/C595M Types GU, HE, MS, or HS.
      4) Fly Ash: ASTM C618.
      5) Aggregate: ASTM C404.
      6) Water: Clean and free from deleterious acids, alkalies, and organic matter.
   c. Coarse Grout: Adjust aggregate proportions as necessary to provide an evenly graded mix which will be easily pumped, with coarse aggregate content no greater than maximum specified in the proportion specifications of ASTM C476.
   d. Grout Barriers for vertical cores: Made of fine mesh wire, fiberglass, or expanded metal.

J. Packaged Mortar Material:
1. Complying with ASTM C1142, Types RN, RS, and RM.
2. Exceeds performance of the field-mixed mortar design.

K. Packaged Dry Material for Grout for Masonry:
1. Complying with ASTM C476 with the addition of water only.
2. Exceeds performance of the field-mixed grout design.

2.6 ACCESSORIES

A. Ties and Anchors:
1. Provide wire or sheet metal ties and anchors that are made from materials that comply with one of the following:
   a. Stainless-Steel Wire: AISI Type 304 or Type 316
   b. Hot-Dip Galvanized, Carbon Steel Wire: ASTM A153/A153M, Class B-2
   c. Epoxy Coated: ASTM C1157/C1157M Class C Epoxy, greater than 20 mils thick.
2. Wire Ties:
   a. General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8 inch cover on outside face.
   b. Wire: Fabricate from 3/16 inch minimum diameter wire.
   c. Tie Section: Provide rectangular-shaped wire ties with closed ends not less than 4 inches wide, or provided triangular-shaped wire ties with outer ends bent to extend 2 inches parallel to face of veneer.
3. Adjustable Anchors:

a. Provide ties that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
b. Structural Performance Characteristics: Capable of withstanding specified building design loads in both tension and compression without deforming or developing play in excess of 1/16 inch.
c. Type: Provide double eye-and-pintle type wire ties, or provide triangular wire ties with slotted sheet metal connector.
d. Adjustability: Ties adjustment: be limited to 1-1/4 inches.

4. Seismic Masonry-Veneer Ties:
   a. Provide ties with a connector section designed to engage a continuous horizontal wire embedded in the veneer mortar joint.
5. Fasteners:
   a. Provide mechanical fasteners to secure masonry ties to backup wall substrate.
   b. Material: Provide fasteners of the same corrosion resistant material as masonry ties and anchors.

B. Joint Reinforcement:
   1. Factory fabricated from steel wire conforming to ASTM A1064/A1064M, welded construction.
      a. Tack welding will not be acceptable in reinforcement used for wall ties.
         1) Wire with a zinc coating conforming to ASTM A153/A153M, Class B-2.
         2) Wires with a minimum gauge per project requirements.
         3) Reinforcement: Ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units.
         4) Joint reinforcement: Place a minimum of 5/8 inch cover from either face. The distance between cross wires will not exceed 16 inches. Furnish Joint reinforcement for straight runs in flat sections not less than 10 ft. long.
         5) Joint reinforcement provide with factory formed corners and intersections.

C. Bar Positioners:
   1. Use to prevent displacement of reinforcing bars during the course of construction.
   2. Provide factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish.
   3. Allow no more than one wire to cross the cell.
   4. Telescoping bar positioners: Manufactured from AISI 1065 spring steel and coated in accordance with ASTM B633.

D. Preformed Control Joints:
   1. Rubber or PVC material. Provide with corner and tee accessories, fused joints Control Joint.

E. Expansion Joint Materials:
   1. Backer rod and sealant adequate to accommodate joint compression equal to 50 percent of the width of the joint with backer rod of compressible type suitable to prevent three-sided adhesion. See Section 079005 - Joint Sealers.
   2. Expansion Joint Material compression up to 50 percent; manufactured of closed cell neoprene conforming to ASTM D1056, RE41:
      a. Adhesive on one side and 1/4 inch thick at Horizontal Joints.
      b. No adhesive and 3/8 inches thick at Vertical Joints.

F. Sheet Metal Flashing:
   1. See 076200 - Sheet Metal Flashing and Trim.

G. Weep Hole Ventilators:

1. Prefabricated plastic, blocking sized to form the proper size opening in head joints.
2. Provide aluminum and plastic inserts with grill or screen-type openings designed to allow the passage of moisture from cavities and to prevent the entrance of insects.
3. Ventilators: Size to match modular construction with a standard 3/8 inch mortar joint.

H. Cavity Mortar Control:
1. Provide factory-manufactured synthetic mortar netting comprised of high-density polyethylene (HDPE) strands woven into a 90 percent open mesh. Profiled as a dovetail with alternating heights to prevent mortar droppings from restricting weep.

I. Cleaning Solution:
1. Non-acidic, not harmful to masonry work or adjacent materials.
2. Basis of Design: Sure Klean 600 Detergent by ProSoCo or a comparable product by one of the following:
   a. Evonik Corporation.
   b. Substitutions: See Section 016000 - Product Requirements.

J. Brick Sealer:
1. Basis of Design: Lastiseal by Novion Inc./RadonSeal or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Clean substrate free of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 1/8 inch.
B. Sandblast if necessary to remove laitance from pores and to expose the aggregate.
C. Ensure that exterior sheathing and weather-resistive air barriers are installed and transitioned per the project documents prior to erecting masonry units.
D. Do not compromise or otherwise harm the continuity of a continuous air and weather resistive barrier system specified in Section 072500 - Weather Barriers.
E. Provide continuous semi-rigid or rigid insulation complying with Section 072100. Formwork fit tightly around penetrations and masonry anchors.
F. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION - GENERAL

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
B. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Lay masonry units in the bond pattern per project requirements. Adjust each unit to its final position while mortar is still soft and plastic.
C. Remove clean and re-lay units that have been disturbed after the mortar has stiffened, with fresh mortar. Keep free from mortar and other debris air spaces, cavities, chases, expansion joints, and spaces to be grouted.
D. Select units used at the exposed masonry surface from those having the least amount of chipped edge or other imperfections detracting from the appearance of the finished work.
E. Keep units being laid and surfaces to receive units free of water film and frost. Mortar for veneer wythes: Bevel and slope toward the center of the wythe from the cavity side.
F. Shove units into place so that the vertical joints are tight.
G. Completely fill vertical joints of brick and the vertical face shells of concrete masonry units with mortar, except where indicated at control, expansion, and isolation joints
H. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted.
I. Unfinished Work:

1. Step back unfinished work for joining with new work. Toothing may be resorted to only when specifically approved. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

J. Cutting and Fitting: Use full units of the proper size wherever possible. Use power masonry saws and skilled masonry mechanics for cutting and fitting, including that required to accommodate the work of others.
   1. Concrete masonry units may be cut wet or dry.
   2. Dry wet cut units, before being placed in the work. Dry to the same surface-dry appearance as uncut units being laid.
   3. Cut edges clean, true, and sharp.
   4. Openings in the masonry: Make carefully so that wall plates, cover plates, or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints.
   5. Provide reinforced masonry lintels above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

K. Jointing: Tool joints when the mortar is thumbprint hard. Tool horizontal joints last. Brush joints to remove all loose and excess mortar. Mortar joints finishes:
   1. Flush Joints:
      a. Flush cut: Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas.
      b. Make by cutting off the mortar flush with the face of the wall.
      c. Use at joints in unparged masonry walls below grade.
      d. Use for architectural units, such as fluted units. Completely fill both the head and bed joints.
   2. Tooled Joints (slightly concave):
      a. Use at joints in exposed exterior and interior masonry surfaces.
      b. Tool with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit.
      c. Perform so that the mortar is compressed and the joint surface is sealed.
      d. Use a jointer of sufficient length to obtain a straight and true mortar joint.
   3. Door and Window Frame Joints:
      a. On the exposed interior side of exterior frames, rake to a depth of 3/8 inch, joints between frames and abutting masonry walls.
      b. On the exterior side of the exterior frames, rake to a depth of 3/8 inch, joints between frames and abutting masonry walls.
   4. Joints Between Dissimilar Materials:
      a. Seal joints between masonry and dissimilar materials with backer rod and sealant, unless otherwise directed by EOR.
   5. Joint Widths:
      a. Brick joint widths are the difference between the actual and nominal dimensions of the brick in either height or length.
      b. Brick expansion joint widths: As indicated.

L. Embedded Items:
   1. Fill spaces around built-in items with mortar. Point openings around flush-mount electrical outlet boxes in wet locations with mortar.
   2. Embed anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in as the masonry work progresses.

3. Fully embed anchors, ties and joint reinforcement in mortar. Fill cells receiving anchor bolts and cells of the first course below bearing plates with grout.

M. Joint reinforcement:
1. Install joint reinforcement at 16 inches on center or as indicated. Lap reinforcement not less than 6 inches.
2. Install prefabricated sections at corners and wall intersections. Place the longitudinal wires of joint reinforcement to provide not less than 5/8 inch cover to either face of the unit.

N. Expansion joints:
1. Provide joints subject to movement (seismic, thermal, shrinkage, etc.) as indicated.
2. Provide continuous vertical joints where designed for movement, including through bond beams.
3. In single wythe exterior masonry walls, provide open control joints with backer rod and sealant. Install sealant per Section 079005 - Joint Sealers.
4. Rake exposed interior control joints to a depth of 1/4 inch.
5. Cut concealed control joints flush.

O. Shelf Angles:
1. Provide hot-dipped galvanized shapes in conformance with ASTM A123/A123M.
2. Provide sections not longer than 10 feet with 1/4 inch gap between sections.
3. Miter and weld shelf angles at building corners with each angle not shorter than 4 feet, unless limited by wall configuration.
4. Adjust shelf angles as required to keep masonry level and at the proper elevation per drawings.

P. Lintels:
1. Masonry Lintels:
a. Construct masonry lintels with lintel units filled solid with grout in all courses and reinforced with minimum two Number 4 bars in the bottom course unless otherwise indicated on the drawings.
b. Extend lintel reinforcement beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater.
c. Support reinforcing bars in place prior to grouting and locate 1/2 inch above the bottom inside surface of the lintel unit.
2. Precast Concrete and Steel Lintels:
a. Construct precast concrete and steel lintels as shown on the drawings.
b. Set lintels in a full bed of mortar with faces plumb and true.
c. Steel and precast lintels: Provide a minimum bearing length indicated on the drawings.

3.4 ANCHORING MASONRY VENEERS

A. General: Strictly conform to intervals and methods indicated.
1. Anchorage to Concrete: Use manufacturer’s pre-engineered concrete fastener.
2. Anchorage to Structural Steel: Use manufacturer’s pre-engineered, self-tapping fastener. Ensure fastener penetrates through cross-section of steel member a minimum of 3/8 inch.
3. Anchorage to Wood: Use anchor manufacturer’s pre-engineered, self-drilling fastener. Ensure fastener engages into framing members / solid blocking square and at depth indicated.

B. Spacing: Space anchors as indicated, but not more than:
1. Non-seismic:

a. 18 inches on center vertically and 32 inches on center horizontally, with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of all wall openings, and at intervals not exceeding 36 inches around the perimeter.

2. Seismic:
   a. 18 inches on center vertically and 24 inches on center horizontally, with not less than 1 anchor for each 2.0 sq. ft. of wall area. Install additional anchors within 12 inches of all wall openings, and at intervals not exceeding 24 inches around the perimeter.

C. Position: Position ties to extend at least halfway through veneer but with at least 5/8 Inch cover on outside face.

3.5 FIELD QUALITY CONTROL

A. Testing:
   1. Mortar Test: For each mix type required.
      a. Compressive strength: ASTM C109/C109M.
      b. Water retention: ASTM A899.
      c. Air content: ASTM C91/C91M.
   2. Grout Test: Compressive strength for each mix required per ASTM C1019.

B. Tolerances:
   1. Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Square corners unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, lay masonry within the following tolerances.
   2. Variation from Plumb in the lines and surfaces of columns, walls, and arrises:
      a. In adjacent masonry units: 1/8 inch.
      b. In 10 feet: 1/4 inch.
      c. In 20 feet: 3/8 inch.
      d. In 40 feet or more: 1/2 inch.
   3. Variations from Plumb for external corners, expansion joints, and other conspicuous lines:
      a. In 20 feet: 1/4 inch.
      b. In 40 feet or more: 1/2 inch.
   4. Variations from level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
      a. In 20 feet: 1/4 inch.
      b. In 40 feet or more: 1/2 inch.
   5. Variation from level for bed joints and top surfaces of bearing walls:
      a. In 10 feet: 1/4 inch.
      b. In 40 feet or more: 1/2 inch.
   6. Variations from horizontal lines:
      a. In 10 feet: 1/4 inch.
      b. In 20 feet: 3/8 inch.
      c. In 40 feet or more: 1/2 inch.
   7. Variations in cross sectional dimensions of columns and in thickness of walls:
      a. Minus: 1/4 inch.
      b. Plus: 1/2 inch.

3.6 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.
B. Remove excess mortar and grout from surface units.

3.7 PROTECTION

A. Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.8 MASONRY WATER REPELLENT AND GRAFFITI CONTROL

A. Strictly conform to manufacturer's published instructions prior to commencement of sealer application.
B. Ensure sealers will not promote a deleterious effect on adjacent wall system components.
C. Project adjacent areas and finishes not intended to receive masonry sealers. Do not permit sealer to run off masonry onto glazing, fixtures, flashings, or joint sealants. Ensure joint sealants have adequately cured or are protected as required prior to application of sealers.
D. Dilute sealers with clean, potable water with mixing vessels free of contaminants. Apply solution to masonry surfaces immediately after mixing.
E. Install sealers "wet-on-wet" to a visibly dry and absorbent surface.
F. Spray Application: Saturate starting from bottom, creating a 4 to 8 inch rundown below contact point. Allow first application to penetrate for a minimum of 3 minutes. Resaturate.
G. Roller Application: Saturate surface in a uniform manner. Allow first application to penetrate for a minimum of 3 minutes. Brush out heavy runs.
H. Protect treated surfaces from rain for 4 hours until visibly dry.
I. Clean tools and equipment immediately with soap and warm water.

3.9 SCHEDULE

A. Mortar Use:
    1. Type M masonry mortar: Use when masonry is in contact with earth, and a high degree of compressive strength is required.
    2. Type N mortar shall be used where improved workability is desired over strength, durability, and corrosion protection at interior conditions.
    3. Type S masonry mortar:
        a. Use for reinforced masonry requiring both compressive strength and lateral load resistance.
        b. Use for foundation walls.
        c. Use for remaining masonry work except where higher compressive strength is indicated on structural drawings.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural steel.
B. Prefabricated building columns.
C. Field-installed shear connectors.
D. Grout.

1.2 RELATED REQUIREMENTS

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
C. Heavy Sections: Rolled and built-up sections as follows:
    1. Shapes included in ASTM A6/A6M with flanges thicker than 1-1/2 inches.
    2. Welded built-up members with plates thicker than 2 inches.
    3. Column base plates thicker than 2 inches.
D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2022.
B. AISC 360 - Specification for Structural Steel Buildings 2022.
C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
D. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength 2014.
E. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength 2014a.
F. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2022.
G. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.
H. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2019.
I. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry 2018.
J. ASTM E709 - Standard Guide for Magnetic Particle Testing 2021.
K. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film 2017.
L. ASTM F1852 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength 2011.
M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
N. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals 2016.
O. SSPC-QP3 - Certification Standard for Shop Application of Complex Protective Coating Systems 2010.

P. SSPC-SP 2 - Hand Tool Cleaning 2018.
Q. SSPC-SP 3 - Power Tool Cleaning 2018.

1.5 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: Show fabrication of structural-steel components.
    1. Shop drawings shall be produced by the Contractor or Contractor's Subcontractor and shall not include any direct reproductions of the Structural Drawings or Structural CAD.
    2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
    3. Include embedment Drawings.
    4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
    5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
    6. Identify members and connections of the Seismic-Load-Resisting System.
    7. Indicate locations and dimensions of protected zones.
    8. Identify demand critical welds.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, shop-painting applicators, and professional engineer
B. Welding certificates.
C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
D. Survey of existing conditions.
E. Field quality-control and special inspection reports.

1.9 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD
    1. Non AISC-Certified Fabricators shall have five years minimum experience on similar projects of equal or larger complexity and scope. Qualifications shall be submitted two weeks prior to bid.
B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
    1. Non AISC-Certified Installers shall have five years minimum experience on similar projects of equal or larger complexity or scope. Qualifications shall be submitted two weeks prior to bid.
C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
E. Comply with applicable provisions of the following specifications and documents:
   1. See Structural General Notes.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.

PART 2 PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. See Structural General Notes.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. See Structural General Notes.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
   1. Color: Gray.
B. Galvanizing Repair Paint: ASTM A780/A780M.

2.4 GROUT

A. See Structural General Notes.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A6/A6M and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."
F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS

D1.1/D1.1M and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

H. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces of high-strength bolted, slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces.
   6. Surfaces enclosed in interior construction.
   7. Interior Structure not indicated as painted.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 FIELD PAINTING

A. Damage of shop paint or exposed rusted metal spots shall be cleaned and painted before erection. Paint shall be same as applied by fabricator.
B. After erection, all steel exposed to earth or weather shall be painted with a 2nd coat of rust inhibitive paint.
C. After erection, all abrasions or damaged paint marks, including bolts, nuts and welds, shall be touched up with shop paint by the erector.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
    1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
    2. Galvanize lintels, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
    1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
    1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
    1. Set plates for structural members on wedges, shims, or setting nuts as required.
    2. Weld plate washers to top of baseplate.
    3. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
        a. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
    1. Level and plumb individual members of structure.
    2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
E. Splice members only where indicated.
F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
    1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
    2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth where indicated in the Contract Drawings.
    3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections, as well as those outlined in the Structural General Notes:
    1. Verify structural-steel materials and inspect steel frame joint details.
    2. Verify weld materials and inspect welds.
    3. Verify connection materials and inspect high-strength bolted connections.
B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts."
D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
    1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
        a. Liquid Penetrant Inspection: ASTM E165/E165M.
        b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
        c. Ultrasonic Inspection: ASTM E164.
        d. Radiographic Inspection: ASTM E94/E94M.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 FIELD PAINTING

A. Damage of shop paint or exposed rusted metal spots shall be cleaned and painted before erection. Paint shall be same as applied by fabricator.
B. After erection, all steel exposed to earth or weather shall be painted with a 2nd coat of rust inhibitive paint.
C. After erection, all abrasions or damaged paint marks, including bolts, nuts and welds, shall be touched up with shop paint by the erector.

3.7 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A780/A780M.
B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

3.8 IMPROPER FIT OF STEEL WORK

A. All framing or connections that do not properly fit, or are not located according to plans, shall be modified or replaced at contractor’s expense. Contractor shall submit to the Architect drawings and proposals for modifications and replacement, for approval. No work shall proceed until approval is received, but temporary shoring and bracing shall be placed until approved corrections are made.

END OF SECTION

SECTION 051213 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Architecturally exposed structural-steel (AESS).

1.2 RELATED REQUIREMENTS

A. 099000 - Painting and Coating: For surface preparation, priming, and topcoat requirements.

1.3 DEFINITIONS

A. Architecturally Exposed Structural Steel: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013000 - Administrative Requirements.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.5 SUBMITTALS

A. Qualification Data: For installer, fabricator, and shop-painting applicator.

B. Shop Drawings: Show fabrication of AESS components.
   1. Indicate welds by standard AWS symbols. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
   2. Indicate type, size, and length of bolts. Indicate orientation of bolt heads.

C. Samples: Submit samples of AESS to set quality standards for exposed welds.
   1. Two steel plates, 3/8 by 8 by 4 inches (9.5 by 200 by 100 mm), with long edges joined by a groove weld and with weld ground smooth.
   2. Steel plate, 3/8 by 8 by 8 inches (9.5 by 200 by 200 mm), with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches (100 by 150 by 9.5 mm), welded to plate with a continuous fillet weld and with weld ground smooth and blended.

D. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

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.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

B. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, AISC 201.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

B. As required by the manufacturer for a warrantable installation of the installed products to meet the Performance and Design Criteria.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate application of shop primers and topcoats with requirements of Division 09 painting sections.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Structural steel which requires a higher level of finish, detailing, or tolerance than industry standard structural steel.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Type 1, round-head assemblies.

B. Corrosion-Resisting (Weathering Steel), Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Type 3, round-head assemblies.

2.3 PRIMER

A. Primer: Comply with Section 099000 - Painting and Coating.

2.4 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

B. Category 1 AESS : Basic elements: In addition to special care used to handle and fabricate AESS, employ the following fabrication techniques.

1. Surface preparation to SSPC-SP 6; prior to blast cleaning, grease and oil are removed by solvent cleaning to meet SSPC-SP 1.
2. Surface condition of steel given in ASTM A6/A6M shall be acceptable.
3. Sharp edges ground smooth; rough surfaces are deburred and ground smooth. Sharp edges resulting from flame cutting, grinding and especially shearing are softened.
4. Continuous weld appearance; intermittent welds are made continuous, either with additional welding, caulking or body filler. For corrosive environments, all joints are seal welded. Seams of hollow structural sections are acceptable as produced.
5. Standard structural bolts; all bolt heads in connections are on the same side, as specified, and consistent from one connection to another.
6. Weld shall meet AWS D1.1/D1.1M and spatters removed; Weld spatter, slivers, surface discontinuities are removed. Weld projection up to 1/16 in. is acceptable for butt and plug welded joints.
7. Seams of HSS shall be acceptable as produced.
8. Weld show-through shall be acceptable as produced.
9. The permissible tolerances for member depth, width, out of square, and camber and sweep shall be as specified in ASTM A6/A6M and ASTM A500/A500M.

C. Category 2 AESS : Feature elements viewed at a distance greater than 20 ft: In addition to the requirements specified for fabrication of Category 1 AESS, employ the following:

1. Visual samples are optional at the request of the Architect; visual samples are either a 3-D rendering, a physical sample, a first-off inspection, a scaled mock-up or a fullscale mock-up, as specified in the contract documents.

2. The as-fabricated straightness tolerance for the member as a whole shall be one-half standard fabrication tolerance for standard structural steel as specified in ASTM A6/A6M and ASTM A500/A500M.
3. Fabrication marks not apparent; members markings during the fabrication and erection processes are not visible.
4. Welds uniform and smooth.
5. Seams of HSS shall be acceptable as produced.
6. Weld show-through shall be acceptable as produced.

D. Category 3 AESS : Feature elements viewed at a distance less than 20 ft: In addition to the requirements specified for fabrication of Category 2 AESS, employ the following:
1. Mill marks removed; all mill marks are not visible in the finished product.
2. Butt and plug welds ground smooth and filled; caulking or body filler is acceptable.
3. HSS weld seam oriented for reduced visibility; seams are oriented away from view or as indicated.
4. Cross sectional abutting surface aligned; the matching of abutting cross sections is required.
5. Joint gap tolerances minimized; similar to C.2 above, a clear distance between abutting members of 1/8 in. is required.
6. All welded connections; hidden bolts may be considered and approved by Architect.
7. Weld show-through shall be acceptable as produced.
8. Copes, miters and cuts in surfaces exposed to view shall have a gap that is uniform within 1/8 in., if shown to be an open joint. If instead the joint is shown to be in contact, the contact shall be uniform within 1/16 in.

E. Category 4 AESS : Showcase elements with special surface and edge treatment beyond fabrication: In addition to the requirements specified for fabrication of Category 3 AESS, employ the following:
1. HSS seam not apparent; HSS seams are treated so they are not apparent..
2. Welds contoured and blended; in addition to a contoured and blended appearance, welded transitions between members also are contoured and blended.
3. Surfaces filled and sanded; steel surface imperfections are filled and sanded.
4. Weld show-through minimized; weld show-through on the back side of a welded element can be minimized by hand grinding the back side surface. The degree of weld-through is a function of weld size and material. Address weld show-through in mockup.

F. Curved AESS:
1. For curved structural members, whether composed of a single standard structural shape or built-up, the as-fabricated variation from the theoretical curvature shall be equal to or less than the standard camber and sweep tolerances permitted for straight members in ASTM A6/A6M and ASTM A500/A500M.

G. The fabricator shall handle the steel with care to avoid marking or distorting the steel members:
1. Slings shall be nylon-type or chains or wire rope with softeners.
2. Care shall be taken to minimize damage to any shop paint or coating.
3. When temporary braces or fixtures are required during fabrication or shipment, or to facilitate erection, care shall be taken to avoid blemishes or unsightly surfaces resulting from the use or removal of such temporary elements.
4. Tack welds not incorporated into final welds shall be treated consistently with requirements for final welds.
5. All backing and runoff tabs shall be removed and the welds ground smooth.

6. All bolt heads in connections shall be on the same side, as specified, and consistent from one connection to another.

H. Members fabricated of unfinished, reused, galvanized or weathering steel that are to be AESS may still have erection marks, painted marks or other marks on surfaces in the completed structure. Special requirements, if any, shall be specified as Category AESS C.

I. Bolt Holes: Cut, drill, thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

J. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
   2. Use weld sizes, fabrication sequence, and equipment that limit distortions to allowable tolerances.
   3. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where AESS is exposed to weather.
   4. Provide continuous welds of uniform size and profile where AESS is welded.
   5. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus 0 inch (plus 1.5 mm, minus 0 mm).
   6. Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus 0 inch (plus 1.5 mm, minus 0 mm). Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
   7. Remove backing bars or runoff tabs; back-gouge and grind steel smooth.
   8. At locations where welding on the far side of an exposed connection of AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
   9. Make fillet welds oversize and grind to uniform profile with smooth face and transition.
   10. Make fillet welds of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

2.6 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
   5. Galvanized surfaces.

B. Surface Preparation: In accordance with Division 09 painting Sections.

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
   1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
   2. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

2.8 ACCESSORIES

A. All accessory materials required to comply with EQ credit: Low Emitting Materials, in accordance with Section 013515 - LEED Certification Procedures.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 013515 - LEED Certification Procedures.
B. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment.
   1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
B. Set AESS accurately in locations and to elevations indicated and according to AISC S303 and AISC 360.
   1. Erect AESS to the tolerances specified in AISC S303 for steel that is designated AESS.
C. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts" for type of bolt and type of joint specified.
   1. Orient bolt heads in same direction for each connection and to maximum extent possible in same direction for similar connections.
B. Weld Connections:
   1. Remove backing bars or runoff tabs; back-gouge and grind steel smooth.
   2. Remove erection bolts, fill holes, and grind smooth.
   3. Fill weld access holes and grind smooth.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Division 05 Section "Structural Steel Framing." The testing agency will not be responsible for enforcing requirements relating to aesthetic effect.
B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.5 REPAIRS AND PROTECTION

A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.
B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing with molten zinc repair method in accordance with ASTM A780/A780M.

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Delegated design of cold-formed metal framing.

B. Formed steel stud exterior wall and interior wall framing.

1.2 RELATED REQUIREMENTS

A. 092219 - Non-Structural Metal Framing: Lightweight, non-load bearing metal stud framing.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013000 - Administrative Requirements.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.4 SUBMITTALS

A. Qualification Data: For manufacturer, design engineer, and installer.

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: Provide data on standard framing members; describe materials and finish, product criteria, limitations. Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work. Shop drawings shall be produced by the Contractor or Contractor's Subcontractor and shall not include any direct reproductions of the Structural Drawings or Structural CAD.

1. Indicate stud layout.
2. Describe method for securing studs to tracks and for bolted framing connections.

E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualification: Company specializing in the manufacture of work specified in this section with minimum of 5 years of 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 of 5 years of experience.

1.6 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.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Formed steel stud exterior wall and interior load bearing wall framing.

B. Framing System: Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

C. Framing Materials: Studs and track; joists and purlins; and framing connectors.

D. Light-gauge, non-loading bearing, metal framing where noted.

E. Wall Sheathing: Select from plywood, particleboard, fiberboard, gypsum, glass mat faced gypsum, extruded polystyrene gypsum, polyisocyanurate foam board.

F. Fasteners: Self-drilling, self-tapping; anchorage device and welding.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
B. Structural Performance: For elements not indicated in the Structural Drawings - Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
C. Design Loads: As indicated on the drawings.
D. Live load deflection meeting the following, unless otherwise indicated:
   1. Exterior Walls: Maximum horizontal deflection under wind load of 1/180 of span.
   2. Design non-axial loadbearing framing to accommodate not less than 1/2 in vertical deflection.
E. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
F. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.3 MANUFACTURERS

A. Metal Framing:
   1. CEMCO: www.cemcosteel.com.
   2. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   3. Marino: www.marinoware.com.
   4. The Steel Network, Inc: www.SteelNetwork.com.
   5. Scafco: www.scafco.com

2.4 MATERIALS

A. Framing Materials:
   1. See Structural General Notes.

2.5 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. Bracing, Furring, Bridging:
   1. Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
C. Plates, Gussets, Clips:
   1. Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.
D. Shop and Touch-Up Primer:
   1. SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
E. All accessory materials required to comply with EQ credit: Low Emitting Materials, in accordance with Section 013515 - LEED Certification Procedures.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.
B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 013515 - LEED Certification Procedures.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
B. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
C. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.
D. Place studs at on-center dimensions required by design, not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.
E. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
F. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
G. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
H. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
I. Install intermediate studs above and below openings to align with wall stud spacing.
J. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
K. Attach cross studs to studs for attachment of fixtures anchored to walls.
L. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
M. Touch-up field welds and damaged galvanized surfaces with primer.
N. All miscellaneous installation materials required to comply with EQ credit: Low Emitting Materials, in accordance with Section 013515 - LEED Certification Procedures.

3.4 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch.
B. Maximum Variation of any Member from Plane: 1/4 inch.

3.5 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

END OF SECTION

SECTION 062000 - FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finish carpentry materials.
B. Hardware.

1.2 RELATED REQUIREMENTS

A. 099000 - Painting and Coating: for field finish of finish carpentry items.

1.3 SUBMITTALS

A. Qualification Data: For fabricator.
B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for attachment hardware and finish hardware.
C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.
   2. Provide the information required by AWI/AWMAC/WI (AWS) Architectural Woodwork Standards.
D. Sample: Submit three samples of each type of wood exposed to view, 11 inches by width of board (or 8 inches max) inch in size illustrating wood grain and specified finish.
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.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.

1.5 DELIVERY, STORAGE, AND HANDLING

A. As required by the Quality Certification Program for installation of the installed products to meet the Performance and Design Criteria.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Wood frames, dimensional lumber and plywood, wall base, and other wood trim, moldings, bases, casings, and miscellaneous trim for doors, glazed lights, window sills, loose shelving. Carpentry items shop fabricated and finished in accordance with AWI/AWMAC/WI (AWS) Architectural Wood Work standards.

2.2 MATERIALS

A. Interior Woodwork Items:
   1. **(WD-1) Crown Cornic Molding**:
      a. Species: Pine.
      b. Finish: Painted.
      c. Color: (P-3).
      d. Styles:
         1) Style 1: Fascia Mounting: Lower edge for soffits.
         2) Style 2: Soffit Mounting: Used for Cornice Design #8.

3) Style 3: Fascia Mounting: Soffit leg may be hemmed and hooked onto brackets for a stand-alone molding.
4) Style 4: Soffit Mounting: Soffit leg may be hemmed and hooked onto brackets for a stand-alone molding.
5) Style 5: Eave and Fascia Mounting: Lower edge for soffits or other molding; soffit leg may be hemmed and hooked onto brackets for a stand-alone mounting.
6) Style 6: Fascia Mounting; Lower edge for soffits or other molding. Used as a termination or stand-alone molding.
7) Style 7: Soffit Mounting: Used for Cornice Design #8.

2. **(WD-2) Wood Base**:
   a. Species: Pine.
   b. Finish: Painted.
   c. Color: (P-4).

B. Lumber Materials:
   1. Softwood Lumber: fir species, quarter sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

C. Sheet Materials:
   1. Softwood Plywood Not Exposed to View: Any face species, veneer core; PS 1 Grade A-B; glue type as recommended for application.
   2. Softwood Plywood Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B; glue type as recommended for application.

D. Site Finishing:
   1. In accordance with Section 099000 - Painting and Coating.

2.3 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the requirements of the quality standard specified before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with quality standard specified.

3.3 INSTALLATION

A. General: Install all materials in accordance with quality standard specified based on conditions present.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut to fit adjoining work. Refinish and seal cuts as recommended by quality standard.
   2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
   3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32 inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
   4. Install stairs with no more than 3/16 inch variation between adjacent treads and risers and with no more than 3/8 inch variation between largest and smallest treads and risers within each flight.

C. Install with trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.

3.4 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.5 PROTECTION

A. Protect installed work as required by the quality standard to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 064100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Delegated design of banquettes.
B. Cabinetry.
C. Cabinet Hardware.

1.2 RELATED REQUIREMENTS

A. 062000 - Finish Carpentry: For additional wood-based products.
B. 092219 - Non-Structural Metal Framing: Support framing, grounds, and concealed blocking for metal stud construction.
C. 123600 - Countertops: for countertops installed with casework.

1.3 ADMINISTRATIVE REQUIREMENTS

1.4 SUBMITTALS

A. Qualification Data: For fabricator and installer.
B. Product Data: Provide data for hardware, accessories, and finishes.
C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
    1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.
    2. Provide the information required by AWI/AWMAC/WI (AWS) Architectural Woodwork Standards.
    3. Provide schedule of drawer locations where soft-close drawer slide features are not available; Architect to review and revise style as required.
D. Sample: Submit sample of cabinet panel construction, minimum 12 inches square, illustrating proposed cabinet substrate and finish.
E. Hardware Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
F. Certificate: Submit certification of required wood products, produced from wood complying with FSC STD-01-001, FSC Principles and Criteria for Forest Stewardship.
G. Manufacturer's Installation Instructions: For finishes and hardware. Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
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.

1.5 MAINTENANCE MATERIAL

A. Furnish extra materials described below, before installation begins, that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Professional structural engineer with 5 years of documented experience in design of this work and licensed in the location of the project.
B. Fabricators Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.
C. Installer Qualifications: Company specializing in performing the work of this section with minimum of 5 years of experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. As required by the quality standard and fabricator for a warrantable installation of the installed products to meet the Performance and Design Criteria.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Custom designed and fabricated casework plastic laminate over plywood core and associated accessories and hardware.

2.2 SELECTED INDUSTRY GRADES

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) Architectural Woodwork Standards.
   1. Pattern matching for wood grain veneers and plastic laminate patterns based on selected grade and as indicated below:
      a. Custom Grade: Doors, drawer fronts and false fronts wood grain and laminate pattern to run and match vertically within each cabinet unit.
   2. Veneer Grades in accordance with HPVA HP-1:
      a. Veneer Grade definitions:
         1) A: Where AA premium face grade is not required, but excellent appearance is still important.
         2) B: Where the natural characteristics and appearance of the species are desirable.
   3. Project Required Veneer Grades:
      a. Exposed Surfaces: Grade A.
      b. Semi-Exposed Surfaces: Grade A.
      c. Concealed Surfaces: Grade B.

2.3 MATERIALS

A. Cores:
   1. Premium Veneer Core Plywood for Exposed Decorative Edges: Birch Core; Void-Free; made with binder containing no urea-formaldehyde resin.
   2. Hardwood Plywood: HPVA HP-1; made with binder containing no urea-formaldehyde.
   3. MDF: ANSI A208.2, Grade 130; made with binder containing no urea-formaldehyde resin.
      a. For use at doors and drawers to reduce movement and warping, unless otherwise indicated.

B. Countertop Edge Materials:
   1. Lumber: Maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
   2. Hardwood Edgebanding: Use matching species, color, grain, and grade for exposed portions of wood veneer cabinetry.

C. Plastic Laminate Materials:
   1. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
      a. (PLAM-1) Plastic Laminate: High pressure decorative laminate sheet bonded to substrate.
      b. Manufacturer: Wilsonart.
         1) Substitutions for products by manufacturers other than those listed above: See Section 016000 - Product Requirements.
      c. Performance Criteria:
         1) Flame Retardant Surfaces: HGF, 0.048 inch nominal thickness.
         2) Cabinet Liner: CLS, 0.020 inch nominal thickness.

3) Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

d. Features:
1) Product: Traceless Laminate, Type 138.
2) Thickness: 0.039-inch.
3) Color: Charcoal Velvet 15504-31.
4) Finish: smooth textured; moderate reflective value.
5) Back and End Splashes: Same material, same construction, square top; minimum 4 inches high.
6) Laminate Core Color: Same as decorative surface.

2.4 CABINET HARDWARE

A. Drawer Slides:
1. Basis of Design: Accuride International, Inc.
2. Performance Criteria:
a. Rated medium duty grade for drawer size indicated.
1) Drawer slides rated for 100 lbs. minimum; soft-close feature available.
b. Rated extra heavy duty grade for drawer size indicated.
1) Drawer slides rated for 250 lbs. minimum; soft-close feature not available.
c. Trash, recycle, and compost drawer slides rated for 500 lbs. minimum; soft-close feature not available.
3. Features:
a. Full extension.
b. Soft-close, stay-closed feature where indicated above.

B. Door and Drawer pulls:
1. Manufacturer: Mockett.
2. Performance Criteria:
a. ADA Standards Compliant.
3. Features:
a. Product: DP3 Series.
b. Profile: 1-1/2-inch.
c. Finish: Pewter
d. Overall Length; 6-inches used vertically and horizontally.
e. On Center: 5-inches.
f. Projection: 1-1/2-inches.
g. Number of Holes: 2.

C. Hinges: European-style, concealed, opening to 135 degrees; soft-closing.

2.5 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with Quality Standards.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

B. Assemble cabinets and complete fabrication.
C. Anchor cabinets to structure. Secure with countersunk, concealed fasteners
    1. For shop finished items, use color matched wood filler.
D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
    1. Scribe and cut cabinets to fit adjoining work and repair damaged finish at cuts.
    2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned.
    3. Maintain veneer sequence matching of cabinets with transparent finish.
E. Shop Finishes: Touch up finishing after installation of architectural cabinets. Fill nail holes with matching filler.
    1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.4 ADJUSTING

A. Adjust and lubricate hardware for proper operation. Adjust hardware to center doors and drawers in openings and to provide smooth operation. Complete installation of hardware and accessory items as indicated.

3.5 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.6 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Foam Board Insulation.
- B. Fiber Board Insulation.
- C. Fiber Batt Insulation.
- D. Foam Detailing Insulation.

1.2 RELATED REQUIREMENTS
- A. 092116 - Gypsum Board Assemblies: For acoustic insulation installed as a component of assemblies.

1.3 SUBMITTALS
- A. Qualification Data: For installer, manufacturer, and design engineer.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Shop Drawings: Indicate required flashings, control joints, and expansion joints, and sealing details at openings, projections, penetrations, and sleeves to maintain continuous thermal barrier.
- D. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
  1. Include recommended fastening components and spacing to control sag.
  2. Include manufacturer's recommended product for thermal barrier over foam insulation exposed to interior in accordance with IBC 2012.2603.4.
     a. ". . .tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275."

1.4 QUALITY ASSURANCE
- A. Manufacturer Qualification:
- B. Designer Qualifications:
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum ____ years experience.

1.5 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.

PART 2 PRODUCTS

2.1 DESCRIPTION
- A. Foam board, fiber board, batt and low expansion detailing foam thermal insulation.

2.2 MATERIALS
- A. Foam Board Insulation:
  1. Polyisocyanurate Board Insulation:
     a. Rigid cellular foam, complying with ASTM C1289.
     b. Basis of Design:
        1) ECOMAXci by Rmax.
        2) Thermax by Dow.
        3) Product warranted by roofing manufacturer as component of their system.
     c. Performance Criteria:
        1) Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
        2) Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.

3) Complies with fire-resistance requirements as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285 in cladding systems matching project.
4) Water Absorption: <1 percent by volume, maximum, when tested In accordance with ASTM C209.
5) Water Vapor Transmission: <0.3 perms when tested in accordance with ASTM E96/E96M based on 1 inch thickness.
6) Board Density: 2 lb/cu ft.
7) Compressive Resistance: 25 psi.
8) Thermal Resistance (R Value) at 40 degrees F/inch of thickness: 6.5.
   (a) R-10c.i. at exterior walls.
   (b) R-38 c.i. at roof.

2. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   a. Basis of Design: Johns Manville Fiber Glass Insulation.
   b. Performance Criteria:
      1) Combustibility: Non-combustible, when tested in accordance with ASTM E136.
      2) Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
      3) Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
      4) Thermal Resistance (R Value): R-21.
   c. Application: New if existing shows sign of damage.
   d. Location: Exterior Walls.
3. Mineral Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   a. Basis of Design: MinWool Sound Attenuation Fire Batts by Johns Manville.
   b. Performance Criteria:
      1) Facing: White kraft paper, fiberglass scrim, aluminum foil laminate (ASJ).
      2) Combustibility: Non-combustible, when tested in accordance with ASTM E136.
      3) Manufactured with binder containing no added urea formaldehyde.
      4) Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
      5) Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
      6) Thermal Resistance: R-25.
   c. Location: Stud cavity at Interior Walls.
4. Mineral Fiber Rigid Insulation
   a. Basis of Design: JM CladStone Water and Fire Block Mineral Wool
      1) Location: Exterior walls used as continuous insulation.

2.3 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. Sheet Vapor Retarder: Specified in Section 072500 - Weather Barriers.
C. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

D. Accessories required by the project:
    1. Joint tape.
    2. Insulatation tape.
    3. Continous Insulation Cladding Attachment
        a. Product: STRONGGIRT Z-Girt.
        b. Material: FRP.
        c. Thickness: As required to meet R-10 insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.4 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.5 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 072500 - WEATHER BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Self Adhered Weather Barrier Sheet.
B. Liquid Applied Weather Barrier Coating.
C. Flexible Flashings.

1.2 RELATED REQUIREMENTS

A. 072100 - Thermal Insulation: Vapor retarder and air barrier components installed in conjunction with insulation.
B. 076200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.3 DEFINITIONS

A. Weather Barrier: Assemblies that form water-resistive barriers, air barriers, or vapor retarders.
B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture-resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one month before starting work of this section in accordance with Section 013100 - Project Management and Coordination.
    1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.5 SUBMITTALS

A. Qualification Data: For manufacturer and installer.
B. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.
C. Shop Drawings: Indicate extents, special joint or termination conditions, and conditions of interface with other materials. Indicate line of continuous air barrier at building exterior.
D. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of air barrier system installation.
E. Test Report: Submit report of full-size mockup test for NFPA 285 fire performance.
F. Field test results.
G. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, perimeter conditions requiring special attention, and storage and handling criteria.
H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualification: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience with local product representation available to review product installation.
B. Installer Qualifications: Company specializing in performing the work of this section, using specified materials with minimum 5 years of experience on projects of similar size and complexity.

1.7 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.

1.8 WARRANTY

A. Manufacturer's warranty for air barrier for a period of ten (10) years from date of Purchase.
   1. Preinstallation meeting and jobsite observations by air barrier manufacturer may be required for specified warranty.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Components of vapor retarder and air barrier assemblies under opaque cladding; including liquid, sheet, and flexible transition flashings.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Air Permeability:
   1. The system: Air permeability not to exceed 0.04 cfm/ft2 under a pressure differential listed, when tested per ASTM E2357
B. Air Infiltration: 0.004 cfm/sq ft maximum per ASTM E283.
C. Fire Performance: Tested in accordance with, and complying with the acceptance criteria of, NFPA 285; testing must be performed specifically for this project.
D. Fire Performance: Combustible exterior wall coverings shall be tested in accordance with NFPA 268.
   1. 2012 IBC.1406.1.1.

2.3 MATERIALS

A. Self-Adhered Weather Barrier Sheet:
   1. Manufacturer:
      a. WrapShield SA by VaproShield.
      b. Sopraseal Stick VP by Soprema.
   2. Performance Criteria:
      a. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
      b. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M.
   3. Features:
      a. Material Thickness: _____.
      b. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 6 months weather exposure.
B. Liquid Applied Weather Barrier Coating:
   1. Manufacturer: **Cat-5 Rainscreen by Prosoco**.
      a. Cat-5 Rainscreen by Prosoco.
      b. Sopraseal LM204 by Soprema.
   2. Performance Criteria:
      a. Air Permeance: Pass: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
      b. Water Vapor Permeance: 15 perms, minimum, when tested in accordance with ASTM E96/E96M.
   3. Features:
      a. Material Thickness: 12-15 mils as recommended by manufacturer to attain the performance criteria specified over the substrates present.
      b. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for ultraviolet and weather exposure.

C. Flexible Flashings.
   1. Liquid Flashing Membrane: **R-Guard FastFlash by Prosoco**.
      a. R-Guard Fast-Flash by Prosoco.
      b. Sopraseal Liquid Flashing by Soprema.
   2. Liquid Mastic: Liquid mastic recommended by flashing manufacturer.
   3. Primers, Cleaners, Insulation Adhesive, Joint Compound, and Sealant Materials: As recommended by air barrier manufacturer, appropriate to application, and compatible with adjacent materials.

2.4 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. Air and Weather Barrier Sealant: **R-Guard AirDam by Prosoco**.
C. Fiber-Reinforced Fill Coat and Seam Treatment: R-Guard Joint and Seam Filler by Prosoco.
D. Liquid Flashing Membrane:
   1. At locations recommended by air and water resistant membrane manufacturer.
E. Primer:
   1. Liquid waterborne or solvent-borne primer recommended for substrate by air and water barrier material manufacturer.
F. Counter-flashing and Transition Strips:
   1. Modified bituminous or butyl based, 40-mil thick, self-adhering sheet flashing, polyethylene or foil carrier sheet as location and function dictate.
G. Joint Reinforcing Strip:
   1. Manufacturer's joint reinforcing tape.
H. Substrate-Patching Membrane:
   1. Manufacturer's standard trowel-grade substrate filler.
I. Adhesive and Tape:
   1. Manufacturer's standard adhesive and pressure-sensitive adhesive tape.
J. Metal Flashings:
   1. Per 076200 - Sheet Metal Flashing and Trim.
K. Joint Sealant:
   1. Per 079005 - Joint Sealers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
B. Follow specific requirements for lapping and integration with flashings described in the details to form an air and weather tight installation.
C. Where primer is required, primer substrates at a rate required by air and water barrier manufacturer and allow it to dry. Limit priming to areas that will be covered by material on same day. Re-prime areas exposed for more than 24 hours.
   1. Where required, prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
D. Connect and seal exterior wall air and water barrier material continuously to the following areas where applicable, using accessory materials as indicated in the Drawings:

1. Roofing-membrane, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings.

E. Install air and water barrier as recommended by the manufacturer around window and door rough openings and at penetrations after sheathing is installed and penetrations have been secured. Provide minimum overlaps as require.

F. Coordinate installations with Section 076200 - Sheet Metal Flashing and Trim to provide air tight transitions within the air and weather barrier membrane including but not limited to rough opening and penetration heads, ledger angles, and cross cavity through wall flashings. Install tapes and sealant continuously as required to provide an air tight installation.

G. Secure and/or adhere the air and weather barrier system as required by manufacturer.

H. Ensure that air and weather barrier is air tight, free from holes, tears, and punctures.

I. Cover air and weather barrier system within manufacturer’s recommended exposure timeframe.

3.4 CLEANING

A. Clean dust, dirt, and debris from the surface of air and water resistant barriers prior to installation of furring and/or cladding materials.

B. Dispose of all waste material in accordance with project's Waste Management Plan.

3.5 PROTECTION

A. Protect air and water barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air and weather barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for longer than manufacturer’s recommended timeframe, remove and replace fluid-applied air and weather barrier or install additional, full-thickness, fluid-applied air and weather barrier application after repairing and preparing the overexposed membrane according to fluid-applied air and weather barrier manufacturer's written instructions.
2. Protect fluid-applied air and weather barrier from contact with incompatible materials and sealants not approved by fluid-applied air and weather barrier manufacturer.

B. Repair damage before proceeding with subsequent construction.

C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

D. Remove masking materials after installation.

END OF SECTION

SECTION 073113 - ASPHALT SHINGLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Asphalt shingle roofing.
B. Flexible sheet membranes for eave protection, underlayment, and valley protection.
C. Associated metal flashings and accessories.

1.2 RELATED REQUIREMENTS

A. 076200 - Sheet Metal Flashing and Trim: Edge and cap flashings.

1.3 SUBMITTALS

A. Qualification Data: For manufacturer and installer.
B. Product Data: Provide product criteria, characteristics, and accessories.
C. Shop Drawings: Indicate required flashings and accessories.
D. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
F. Maintenance Data: For users operation and maintenance of system including:
    1. Methods for maintaining system's materials and finishes.

1.4 MAINTENANCE MATERIAL

A. Extra Shingles: 3 packages of each type and color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualification:
    1. Company specializing in the manufacture of work specified in this section with minimum 10 years of experience.
    2. Associate member in good standing of either the National Roofing Contractors Association (NRCA), Western States Roofing Contractors Association (WSRCA) or the Midwest Roofing Contractors Association (MRCA).
B. Installer Qualifications:
    1. Company specializing in performing the work of this section with minimum 5 years experience, operating under the same name and ownership for those 5 years.
    2. A single installer (contractor) shall perform the work, including sheet metal work, as required by this specification.
    3. Approved by the manufacturer to install the specified products and provide the specified warranties.

1.6 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.
B. At ambient temperatures of 70 degrees or greater, take care not to scuff the shingles as they are being installed. In temperatures of 70 degrees or greater shingles must be stored in the shade. Scuffed shingles to be replaced to the satisfaction of owner's representative.
C. Roof deck shall be clean and dry before any roofing work proceeds. Roofing shall not proceed during precipitation, nor when moisture from dew is present, or if precipitation or other moisture source is expected. Roofer shall remove no more roofing than can be covered with new underlayment and shingles in the same day. If unable to install shingles, exposed underlayment shall be covered with tarps.
D. Protection against staining, mechanical damage, and live loads shall be provided for adjacent surfaces as required during application of roofing

1.7 WARRANTY

A. Installation Warranty: Contractor shall correct defective Work within a 2 year period after Date of Substantial Completion.
B. Manufacturer Warranty: 30-year composite material year warranty for shingles.

PART 2 PRODUCTS

2.1 DESCRIPTION
A. Complete roofing assemblies, including factory formed asphalt shingles and installation accessories, tested for conformance with performance criteria.

2.2 PERFORMANCE AND DESIGN CRITERIA
A. Fire Resistance: Class A, when tested in accordance with ASTM D3462/D3462M.
B. Wind Resistance: Class F, when tested in accordance with ASTM D3161/D3161M.
C. Warranted Wind Speed: Not less than tested wind resistance.

2.3 MATERIALS
A. (SHG-1) Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
1. Basis of Design: GAF Timberline Ultra HD. Comparable and substituted products will be judged based on the following performance criteria, features, warranty, and qualifications.
2. Performance Criteria:
a. Impact Resistance: UL 2218 Class 4 classification; without sustained damage.
3. Features:
a. Algae Resistant.
b. Self-Sealing.
c. Weight: 230 pounds /100 square feet.
d. Color: Wood tone to match existing.

2.4 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. Manufacturer's optional accessories required by the project:
1. Self-Adhering Membrane: See Section 072500 Weather Barriers.
2. Nails: Hot dipped galvanized nails (ring shank) for hand nailing of shingles. Staples and pneumatically driven nails not allowed. Nails shall fully penetrate through the underside of the plywood sheathing.
3. Asphalt Mastic: Provide manufacturer's approved asphalt mastic.
4. Lead flashing: Provide 4 lb/s.f. lead flashing for pipe penetrations or conduit. Field solder all joints for conduit penetrations. Where soil stacks or conduit exceed height of lead flashing, provide 6" Batten Seam Cover Tape (as manufactured by Firestone), stainless steel clamping rings, and sealant.
5. Plastic Roof Cement conforming to ASTM D4586/D4586M.
6. Fasteners: Hot dipped galvanized roofing nails for nailing of shingles. Staples are not allowed. Nails shall fully penetrate through the underside of the plywood sheathing.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION
A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION
A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

B. Install secondary products which are acceptable to, and approved by, the manufacturer of asphalt shingles.
C. Install self-adhered membrane at all valleys, eaves, and rakes as shown in the drawings. Install one full sheet self-adhered underlayment centered at valley lines.
D. Install one layer of Right Start UDL underlayment over the entire deck directly before installation of shingles. The underlayment is to be applied perpendicular to the slope of the roof lapping each course over the lower course at least 4 inches. Where end laps join, lap six inches minimum. Extend underlayment through the valleys from both directions, over the self-adhered membrane.
E. Install specified fiberglass reinforced shingles in accordance with manufacturer's instructions using hot dipped galvanized nails, over the underlayment. Install shingles "book style" with trimmed tab starter course, four nails per shingle. Nails are to be placed flush with the shingle surface. Overdriven, underdriven, crooked nails, and nails placed high will not be accepted.
F. Install the starter course with an overhang at the eaves and rakes as recommended by the manufacturer.
G. Valleys to be open sheet metal valleys, installed according to the manufacturer's recommendations with points trimmed.
H. Lead Flashing: Install field soldered 4 lb/s.f. lead flashing at conduit penetrations and applied in shingle fashion with the asphalt shingles. Where soil stacks or conduit exceed the height of lead flashing, seal the top edge with 6" Batten Seam Cover Tape (as manufactured by Firestone), stainless steel clamping rings, and sealant.
I. Step Flashing: Install step flashing one per shingle course lapped up behind the building paper.
J. Mechanical Equipment Curbs and Pipe Penetrations: Raise conduit penetrations, insulated pipes, soil stacks, vents, and mechanical curbs as necessary to obtain a minimum eight (8) inch flashable height above the finished roof plane (unless otherwise shown in the drawings). Include rewiring and duct extensions as necessary to raise or extend conduit or ducts. Perform all work necessary to reinstall and reconnect equipment to fully functioning. All electrical, mechanical, and gas line work to be performed by a journeyman worker experienced and trained in work performed to building code and current industry standards.

3.4 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.5 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 074646 - FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiber cement siding.

1.2 RELATED REQUIREMENTS

A. 072100 - Thermal Insulation: For insulation installed with system.
B. 072500 - Weather Barriers: For weather barrier underlayments installed with system wall panels.
C. 079005 - Joint Sealers: For joint sealant installed with system.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013100 - Project Management and Coordination.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.
   2. Review FM and Owner requirements for quality assurance and testing

1.4 SUBMITTALS

A. Qualification Data: For manufacturer, design engineer, and installer.
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: Provide product criteria, characteristics, accessories, jointing and corner methods, and termination conditions.
D. Shop Drawings: Indicate extents, special joint or termination conditions, and conditions of interface with other materials.
E. Sample:
   1. Actual pieces of panels representing full range of available colors and finishes.
   2. Any exposed framing or clips.
F. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
G. Maintenance Data: For user's 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.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of 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 of experience on projects of similar size and complexity.

1.6 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.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Fiber reinforced cement cladding panels. Panels have various profiles, attachment methods, fiber continent, textures, colors and finishes.

2.2 FIBER CEMENT BOARD

A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.
B. Performance Criteria:
    1. Fire Resistance: non-flammable, non-combustible.
C. Features:
    1. Labeling: Provide fiber-cement soffit that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
    2. Thickness: Not less than 5/16 inch.
    3. Size: As shown on drawings.
    4. Edges: Square cut.
    5. Attachment Method: Concealed fasteners on lap siding. Color match exposed fasteners on panel products.
    6. Finish: To be selected by Architect from manufacturer's full range.

2.3 FIBER CEMENT SIDING

A. Fiber Cement Banding Panel Board.
    1. (FCP-1) Manufacturer: **Cembrit Transpart Facade Board**.
    2. Features:
        a. Thickness: 8 mm.
        b. Width: 1192 mm
        c. Length: 2500 mm.
        d. Color: Match existing Color-2.
        e. Finish: Cembrit Transparent.
B. Fiber Cement Lap Siding:
    1. (FCS-1) Manufacturer: **Cembrit**.
        a. Features:
            1) Panel Size: Lap siding, 7" exposure.
            2) Color: T-242 Antarctic.
            3) Finish: Cembrit Transparent.
    2. (FCS-2) Manufacturer: **Cembrit.**
        a. Features:
            1) Panel Size: Lap siding, 5" exposure.
            2) Color: T-242 Antarctic.
            3) Finish: Cembrit Transparent.
C. Fiber Cement Trim:
    1. (FCT-1) Manufacturer: **Cembrit.**
    2. Features:
        a. Color: Match existing Color-2.
        b. Finish: Cembrit Transparent.

2.4 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 Metal Subframing and Furring:
    1. Material recommended by manufacturer for compatibility with panel base metal and conditions present.
C. Anchors:
    1. Galvanized steel or Stainless steel.
D. Miscellaneous Secondary Framing:

1. Light gauge steel framing incidental to structural supports; fabricated from steel sheet.
    a. Profile: Manufacturer's standard profile for conditions present.
    b. Material: As required for material compatibility with panel sheet material.

E. Cladding Attachment Support System:
1. Material: Pultruded Fiberglass Reinforced Polymer (PFRP); visual quaility conform to ASTM D-4385-19.
2. Manucturer: **Strongirt Pultruded FRP Cladding Attachment Support System by Strongwell Corp.**
3. Performance Criteria:
    a. Tensile Strength (LW): ASTM D638.
    b. Short Beam Shear Strength (LW): ASTM D2344.
    c. Flammability Characteristics: ASTM E84.
    d. Thermal Conductivity: ASTM E1530.
    e. Bearing Load: ASTM D5961.
    f. UV inhibitor.
4. Features:
    a. Thickness: As indicated on Drawings.
    b. Self-draining weep holes.

F. Fasteners:
1. Manufacturer's standard type to suit application. Exposed fastener cap same color as exterior panel.

G. Miscellaneous Sheet Metal Items:
1. Provide flashings, trim, moldings, closure strips color matched to panel color.

H. Sealants:
1. As specified in Section 079005.

I. Internal and External Corners:
1. Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

J. Expansion Joints:
1. Same material, thickness and finish as exterior sheets; 20 gage; manufacturer's standard brake formed type, of profile to suit system.

K. Trim:
1. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

L. 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 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.

3.4 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.5 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.6 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items.

1.2 RELATED REQUIREMENTS

A. 072500 - Weather Barriers: Moisture protection and underlayments under sheet metal flashings.

B. 079005 - Joint Sealers: Sealants installed with sheet metal flashing and trim.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013100 - Project Management and Coordination.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.4 SUBMITTALS

A. Qualification Data: For fabricator.

B. Shop Drawings: Indicate material profile, jointing locations, jointing details, fastening methods, flashings, terminations, and installation details. Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop and field assembled work. Include the following:

1. Identify 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 fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners to adjoining work.

C. Samples:

1. Finish Sample: Submit two samples illustrating each metal finish color.
2. Fabrication Sample: Submit sample of coping lap joint as it will occur every 10 feet.

D. Warranty: Submit manufacturer finish warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Fabricators Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.

1.6 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.

1.7 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

2.1 DESCRIPTION

A. Sheet metal including steel, stainless steel, and aluminum fabricated into items such as flashings, counterflashings, gutters, downspouts, and other items indicated and scheduled.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. General: Install sheet metal flashing and coping to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
   1. Temperature Change (Range): 120 deg, ambient; material surfaces.

2.3 MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal, shop pre-coated with PVDF coating.
   1. Fluoropolymer Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As scheduled below and indicated on drawings.
B. Pre-Finished Aluminum: ASTM B209; 0.032 inch thick; plain finish shop pre-coated with fluoropolymer coating.
   1. Fluoropolymer Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As scheduled below and indicated on drawings.
C. Stainless Steel: for masonry use: ASTM A666 Type 304, soft temper, 0.018 inch thick; smooth mill finish.
D. Stainless Steel: For all other uses: ASTM A666 Type 304, rollable temper, 0.018 inch thick; smooth No. 4 finish.

2.4 FABRICATION

A. Conform to referenced SMACNA manual, Manufacturer's recommendations if premanufactured and as detailed. Conform to following general requirements:
B. Form sections true to shape, accurate in size, square, and free from distortion or defects.
C. Form pieces in longest possible lengths.
D. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
E. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
F. Hem exposed edges 1/2 inch on unexposed side, miter and seam corners, unless noted otherwise.
G. Cleats: Fabricate continuous cleats and starter strips from one gauge heavier material than sheet metal material, in widths required by SMACNA, interlockable with sheet.
H. Fully soldered/welded stainless steel saddle and transition flashings at 3-D transitions such as roof to wall intersections, roof to elevator overrun, and the like.
I. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
J. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection, and as required by SMACNA. Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
K. Shingle laps in flashings: 6-inch minimum, sealed with two distinct beads of bib-skinning butyl sealant at each lap.

2.5 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. Flexible Flashing:

1. For use under metal copings and flashings Section 072500 - Weather Barriers; use high temperature type.

C. Slip Sheet:
1. Rosin sized building paper.

D. Protective Backing Paint: See Section 099000 - Painting and Coating.

E. Sealant: As specified in Section 079005 - Joint Sealers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.4 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.5 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

3.6 SCHEDULE

A. Unless otherwise noted all exposed exterior sheet metal flashing and trim is Pre-Finished Aluminum.

B. Counter Flashing:
1. Material: Prefinished Aluminum.
2. Thickness: 20 gauge/0.0320 inches.
3. Seaming: Fully-welded shop fabricated corners and end dams.

C. Masonry Through Wall flashing:
1. Material: Prefinished Aluminum.
2. Thickness: 20 gauge/0.0320 inches.
3. Seaming: Fully-welded shop fabricated corners and end dams.

D. Gutters:
1. Material: Prefinished aluminum.
2. Finish & Color: Match existing. To be selected from manufacturer's standard colors.

E. Downspouts:
1. Material: Prefinished aluminum.
2. Finish & Color: Match existing. To be selected from manufacturer's standard colors.

F. Window Head Flashing:
1. Material: Prefinished Aluminum.
2. Thickness: 20 gauge/0.032 inches.
3. Color: To be selected from manufacture's standard colors.
4. Seaming: Fully-welded shop fabricated corners and end dams.

G. Coping, Cap, Parapet, Sill and Ledge flashings:
1. Material: Prefinished Aluminum.
2. Thickness: 20 gauge/0.0320 inches
3. Color: To be selected from manufacture's standard colors.
4. Seaming: Butt joint with concealed splice plates.
5. Corners: Fully-welded shop fabricated corners, ends and intersections.

H. Pre-finished Metal Sill Flashing:

1. Material: Prefinished Aluminum.
2. Thickness: 20 gauge/0.0320 inches
3. Color: To be selected from manufacture's standard colors.
4. Seaming: Butt joint with concealed splice plates.
5. Corners: Fully-welded shop fabricated corners, ends and intersections.

I. Pre-finished Aluminum Trim:

1. Material: Prefinished Aluminum.
2. Thickness: 20 gauge/0.0320 inches
3. Color: To be selected from manufacture's standard colors.
4. Seaming: Butt joint with concealed splice plates.
5. Corners: Fully-welded shop fabricated corners, ends and intersections.

END OF SECTION

SECTION 077229 - SLOPED ROOF VENTILATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sloped Roof Ventilation:
   1. Ridge vents.
   2. Dual vents.
   3. Truss vents.
   4. Vented fasciae.
   5. Rake fasciae.
   6. Rake panels.
   7. Drip edges.
   8. Vented screens.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 – Joint Sealants.

1.3 REFERENCE STANDARDS

A. Florida Building Code, Testing Application Standard (TAS) 100 (A) – Test Procedure for Wind and Wind Driven Rain Resistance of Discontinuous Roof Systems.
B. Miami-Dade County, Florida Notice of Acceptance (NOA).

1.4 PREINSTALLATION MEETINGS

A. Convene preinstallation meeting 1 week before start of installation of sloped roof ventilation.
B. Require attendance of parties directly affecting Work of this Section, including Contractor, Architect, installer, and manufacturer’s representative.
C. Review the Following:
D. Materials.
   1. Installation.
   2. Adjusting.
   3. Cleaning.
   4. Protection.
   5. Coordination with other Work.

1.5 SUBMITTALS

A. Comply with Division 01.
B. Product Data: Submit manufacturer’s product data, including installation instructions.
C. Shop Drawings: Submit manufacturer’s shop drawings, including plans, elevations, sections, and details, indicating dimensions, materials, components, fasteners, finish, and accessories.
D. Samples: Submit manufacturer’s sample of sloped roof ventilation.
   1. Sample Length: Minimum 5-1/2 inches (140 mm).
E. Color Samples: Submit manufacturer’s color samples of sloped roof ventilation, consisting of complete color chart representing manufacturer’s full range of available colors.
   1. Submit metal chips of specific colors as requested by the Architect.
F. Manufacturer’s Certification: Submit manufacturer’s certification that sloped roof ventilation complies with specified requirements and is suitable for intended application.
G. Warranty Documentation: Submit manufacturer’s standard warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Manufacturer regularly engaged in the manufacturing of sloped roof ventilation of similar type to that specified for a minimum of 10 years.
B. Installer's Qualifications:
   1. Installer regularly engaged in installation of sloped roof ventilation of similar type to that specified for a minimum of 5 years.

2. Use persons trained for installation of sloped roof ventilation of similar type to that specified following manufacturer's installation instructions.

C. Testing: Meet specified testing requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging.

B. Storage and Handling Requirements:

1. Store and handle sloped roof ventilation in accordance with manufacturer's instructions.
2. Inspect and report damage or other issues to manufacturer within 72 hours of receipt of materials.
3. Keep sloped roof ventilation in manufacturer's original, unopened containers and packaging until installation.
4. Store sloped roof ventilation in clean, dry area indoors.
5. Do not store sloped roof ventilation directly on floor or ground.
6. Protect sloped roof ventilation and finish during storage, handling, and installation to prevent damage.

1.8 WARRANTY

A. Warranty Period, Product:

1. Metal-Era "Hi-Perf" Ventilation Systems: 20 years or lifetime of roof on which it was originally installed, whichever comes first, and when intake and exhaust ventilation is designed by manufacturer as a complete system.

B. Wind: Maximum 130 mph.

1. Other Products: Five-year workmanship warranty covering replacement or repair of products that are defective in material or workmanship.

C. Warranty Period, Finish: Limited 30-year warranty for prefinished coil-coated steel and aluminum coated with Kynar 500 standard colors covering fade, chalk, and film integrity.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Metal-Era, Inc., 1600 Airport Road, Waukesha, Wisconsin 53188. Phone 800-558-2162. Fax 800-373-9156. www.metalera.com. info@metalera.com.

B. Substitutions: Comply with Division 01.

2.2 RIDGE VENTS

A. Ridge Vents: Metal-Era "Hi-Perf" ridge vent, slope-to-slope, shingled version.

B. Water Infiltration Test, TAS 100 (A): Passed.

1. Ridge Vent Cover Material: aluminum.
   a. Formed Lengths: 12'-0" with slotted fastening holes.
2. Cover Plates: At each joint, 8 inches wide.
3. Continuous Z-Brackets: 20-gauge galvanized steel.
4. Intermittent Spacers: 0.050-inch aluminum, 12 inches on center.
5. Expanded Metal Support Screens: 0.050-inch aluminum.
6. Endcaps:
7. Deflectors:
   a. Roof Pitch: Less than 4/12.
   b. Formed Lengths: 12'-0"
   c. Deflector Baffles: At deflector joints, 3-1/2 inches wide.
8. Continuous Z-Brackets, Intermittent Spacers, and Expanded Metal Support Screens: Factory assembled.

2.3 DRIP EDGES

A. Drip Edges: Metal-Era “D-Style” drip edge, eave-edge version.
   1. Drip Edge Material: Aluminum
   2. Formed Lengths: 12’-0” with slotted fastening holes.
B. Slotted Fastening Holes: 6 inches on center.
   1. Concealed Splice Plates: 6 inches wide.

2.4 VENTED SCREENS

A. Vented Screens: Metal-Era “Eco-Perf” vented screen, eave intake.
   1. Vented Screens: 24-gauge galvanized steel
      a. Net Free Area (NFA): 54 percent.
      b. Formed Lengths: 12’-0”
      c. Ends: Pre-notched.
      d. Color: Match existing
   2. Finish: Hylar 5000/Kynar 500
      a. Color: Match existing.

2.5 ACCESSORIES

A. Joint Sealants: Specified in Section 07 92 00.
B. Fasteners: Appropriate for intended substrate.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive sloped roof ventilation.
B. Verify surfaces to support sloped roof ventilation are clean, dry, straight, secure, and of proper dimensions.
C. Notify Architect of conditions that would adversely affect installation.
D. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Install sloped roof ventilation in accordance with manufacturer’s instructions at locations indicated on the Drawings.
B. Remove protective vinyl film immediately before installation.
C. Install sloped roof ventilation watertight.
D. Install sloped roof ventilation to allow for thermal movement.
E. Joint Sealants: Apply joint sealants in accordance with manufacturer’s instructions.

3.3 ADJUSTING

A. Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by Architect.
B. Remove and replace with new material, damaged components that cannot be successfully repaired, as determined by Architect.

3.4 CLEANING

A. Clean sloped roof ventilation promptly after installation in accordance with manufacturer’s instructions.
B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

A. Protect installed sloped roof ventilation to ensure that, except for normal weathering, materials will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 079005 - JOINT SEALERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sealants for exterior surfaces.
B. Sealants for interior surfaces.

1.2 RELATED REQUIREMENTS

1.3 SUBMITTALS

A. Qualification Data: For Manufacturer, Installer, Testing Agency.
B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
C. Preliminary Selection Sample: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
D. Field Samples for Confirmation: Provide sealant samples in the color selected based on Manufacturer's charts for sealants other than the ones included in the Visual and Performance Mockup. Field samples shall be minimum 12 inches long and installed at joints intended for each particular sealant use. Mockup and field samples will be used to confirm sealant color selection.
E. Sanded sealant samples: Include in the Visual and Performance mockup, as part of the brick portion of the mockup.
F. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
G. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
H. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
I. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
    1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
    2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
J. Field Test Report Log: For each elastomeric sealant application.
K. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
L. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner"s name and registered with manufacturer.
M. Maintenance Data: For user's 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. Recommendations on maintenance schedule.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.
B. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project. Minimum 5 years of documented experience in facilities of this size and scope.
    1. Prequalification of single source installers for exterior sealants is encouraged.

C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.5 MOCKUP

A. Construct mockup of 4 lineal feet of sealant at narrowest joint width and widest joint width, representing finished work including internal and external corners and control joints.
B. Locate where directed.
C. Mockup may remain as part of the Work.

1.6 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.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.
B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Ten (10) years from date of Substantial Completion.
C. Special warranties exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Joint sealers for properly designed joints in interior and exterior materials; selected for durability, movement capacity, adhesion to substrates and non-staining characteristics.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
C. Elastomeric Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
D. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

2.3 MANUFACTURERS

A. Specification is based on products listed below.

2.4 MATERIALS

A. Sealants for exterior surfaces:

1. Silyl-terminated polyether elastomeric; ASTM C920, Grade NS, Class 25, Uses NT, M, G, A and O; single, or multi- component.
    a. Color: Standard and custom colors matching finished surfaces.
    b. Product: BASF MasterSeal NP 150
2. Silicone Sealant: ASTM C920, Grade NS, Class 50, Uses NT, A, G, M, O; single component, general purpose, medium modulus, neutral curing, non-sagging, non-staining, non-bleeding.
    a. Movement Capability: +/- 50 percent.
    b. Color: Standard colors matching finished surfaces.
    c. Product: DOWSIL 795 manufactured by Dow.
    d. Designed for weather-proofing typical exterior materials including unprimed adhesion to anodized and fluoropolymer coated aluminum.
3. Surface Modified Silicone Sealant: ASTM C920, Grade NS, Class 50, Uses NT, A, G, M, O; single component, general purpose, medium modulus, neutral curing, non-sagging, non-staining, non-bleeding.
    a. Movement Capability: +/- 50 percent.
    b. Color: Standard colors matching finished surfaces.
    c. Product: DOWSIL 756 manufactured by Dow.
    d. Designed for weather-proofing sensitive porous stone and light colored metal panel substrates.
4. Butyl Sealant: ASTM C1311.
    a. Movement Capability: Plus and minus 12-1/2 percent.
    b. Product: Butyl Sealant by Tremco.
    c. Designed for concealed joints requiring non-drying sealant like lap joints in sheet metal flashing and trim.
5. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single or multi-component.
    a. Movement Capability: +/- 25 percent.
    b. Color: Color as selected to match concrete.
    c. Product: THC 901 by Tremco Inc.
    d. Designed for exposed, trafficked joints with pourable self-leveling installation.
6. Preformed Compressible Foam Sealers.
    a. Movement +25 percent, -25 percent (50 percent total) - permanently elastic.
    b. Color: Color as selected to match concrete.
    c. Product: THC 901 by Tremco Inc.
        1) Backerseal by Emseal.
        2) illmod 600 by Tremco Inc.

B. Sealants for interior surfaces:
1. General Purpose Interior Sealant: polyurethane; single, or multi- component, paintable.
    a. Color: Standard colors matching finished surfaces.
    b. Product: Dymonic FC, Dymeric 240FC by Tremco Inc.
    c. Designed for interior movement and non-moving joints adjacent to painted surfaces.
2. Acoustical Sealant: Acrylic sealant; ASTM C834.
    a. Product: Tremco "Acoustical Sealant".
    b. Non-hardening type.
    c. Tested as part of acoustical assemblies.
3. Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single or multi-component.

a. Approved by manufacturer for wide joints up to 1-1/2 inches.
b. Color: Standard colors matching finished surfaces.
c. Product: Vulkem 45 SSL by Tremco Inc.
d. Designed for exposed, trafficked joints with pourable self-leveling installation.

2.5 ACCESSORIES

A. Joint sealant backing:
1. General:
a. Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
2. Cylindrical Sealant Backings:
a. ASTM C1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
3. Elastomeric Tubing Sealant Backings:
a. Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
4. Bond-Breaker Tape:
a. Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

B. Miscellaneous Materials:
1. Primer:
a. 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.
2. Cleaners for Nonporous Surfaces:
a. Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
3. Masking Tape:
a. Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
4. Natural Sand:
a. Washed natural sand containing no contaminants that would affect the sealant. Color as approved by the architect for sanded joints as indicated or scheduled.

C. 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
B. Joint Sanding: Sand sealant joints at brick and sidewalks.
   1. Immediately after tooling and prior to skinning over of sealant, broadcast sand onto surface of sealant.
   2. Retool by rolling a dowel over the joint to achieve sufficient embedment.
   3. Maintain uniform appearance.

3.4 FIELD QUALITY CONTROL

A. Field quality control to include field adhesion testing, field stain testing, test methods and evaluation of field test results.
B. Perform all corrections necessary for issuance of warranty.

3.5 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.6 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

3.7 SCHEDULE

A. Sealants for exterior surfaces.
   1. Exterior joints occurring in paintable surfaces.
   2. Typical exterior weather-proofing joints including metal to metal, metal to glass and perimeters.
   3. Exterior weather-proofing joints including porous natural stone, unit masonry, veneer masonry, and concrete applications.
   4. Exterior weather-proofing joints at ledger angles in masonry veneer. Sand appearance to match brick mortar appearance. Matching may require several iterations.
   5. Concealed sealants in sheet metal flashing, metal work and other joints calling for nonhardening, nonskinning, non-drying, nonmigrating sealant.
   6. Used as a secondary sealant behind directly-applied liquid sealant. Use at all joints larger than 3/4 inch in width as a secondary sealant.
B. Sealants for interior surfaces:
   1. Typical Interior Sealant: Moving and non-moving Interior wall and ceiling control joints, smoke rated (but not fire rated) partitions.
   2. Joints between plumbing fixtures and floor and wall surfaces. Joints between kitchen, laundry room and bath countertops and wall surfaces.
   3. Use for concealed locations only. Sealant bead between top stud runner and structure and between bottom stud track and floor at any wall designated as acoustical.
   4. Control joints in floors.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-fire rated steel doors.
B. Fire rated steel doors.
C. Non-fire rated steel frames.
D. Fire rated steel frames.
E. Exterior steel frames.

1.2 RELATED REQUIREMENTS

A. 024119 - Selective Demolition.
B. 099000 - Painting and Coating: For field painting.

1.3 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 user's 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.

1.4 QUALITY ASSURANCE

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

1.5 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.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Hollow metal frames for hollow metal doors, wood doors and glazing. Hollow metal doors for fire rated, non-fire rated.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Accessibility Requirements: For doors required to be accessible, comply with applicable provisions in the Accessible and Usable Building Facilities ICC A117.1 and 2010 ADA Standards for Accessible Design – Department of Justice.
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.

2.3 MANUFACTURERS

A. Specification is based on Doors and Frames by one of the following:
    1. Assa Abloy.
    2. Ceco.
    3. Curries.
    4. Fleming.
    5. Steelcraft.

2.4 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. 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 0.37, 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.
      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 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. 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 0.29, 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 ICC (IBC)-2012 716 Tables.
      e. Color: To be selected 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. Assembly: Fully welded.
   b. 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. Assembly: Fully welded.
   b. 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.
2. Features:
   a. Assembly: Fully welded.
   b. Finish: Factory primed, for field finishing.

2.5 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.

2.6 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

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 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.

3.3 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 without groove or pits.
    1. Seal with sealant Per Section 079005 - Joint Sealers.
E. Pack 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.

3.4 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.

3.5 ADJUSTING

A. Adjust and lubricate hardware for proper operation.
B. Adjust for smooth and balanced door movement in accordance with manufacturer's instructions.

3.6 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.7 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

3.8 SCHEDULE

A. Refer to door schedule on drawings.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-fire rated wood doors.
B. Fire rated wood doors.
C. Interior smoke and draft control doors.
D. Sound rated wood doors.

1.2 RELATED REQUIREMENTS

A. 081113 - Hollow Metal Doors and Frames: For frames.
B. 099000 - Painting and Coating: For field painting.
C. 134913 - Integrated X-Ray Shielding Assemblies: For lead lined wood doors.

1.3 SUBMITTALS

A. Qualification Data: For manufacturer.
B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles.
D. Sample: Submit two samples face material, manufacturer's standard size showing factory finishes, colors, and surface texture.
E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
G. Maintenance Data: For user's 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.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
    1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.5 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.

1.6 WARRANTY

A. Interior Doors: Provide manufacturer's warranty for the life of the installation.
    1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Wood doors for non-fire rated openings.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Accessibility Requirements: For doors required to be accessible, comply with applicable provisions in the Accessible and Usable Building Facilities ICC A117.1 and 2010 ADA Standards for Accessible Design – Department of Justice.
B. Quality Level: Custom Grade, Extra Heavy Duty performance, in accordance with WDMA I.S. 1A for all doors with the following exceptions.
C. Construction: Flush.

D. Vertical Edges: Same species as face veneer.
E. Edge type (AWI "E" type) edge set in between door face veneers.
F. Door Edge Profile: Beveled on both edges.
G. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
H. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
I. Source Limitations: For doors and frames, obtain products from single source from single manufacturer.

2.3 MANUFACTURERS

A. Specification is based on doors and frames by one of the following:
   1. Masonite Architectural: Graham-Maiman Wood Doors architectural.masonite.com/graham-maiman/flush-wood-doors/
   2. Lynden Doors: www.lyndendoor.com
   3. VT Industries, Inc: www.vtindustries.com
B. Substitutions for products by manufacturers other than those listed above: See Section 016000 - Product Requirements.

2.4 MATERIALS

A. Wood Veneer Facing:
   1. Wood Veneer Facing for Transparent Finish: Vertical Grain Fir, quarter sawn, slip matched, veneer grade as specified by quality standard.
B. Cores:
   1. Cores Constructed with stiles and rails:
      a. Provide solid blocks_____ for hardware reinforcement.
      b. Provide solid blocking for other throughbolted hardware.
   2. Non-Rated Solid Core and 20 Minute Rated Doors: Type: No Added Urea Formaldehyde particleboard core (PC), plies and faces as indicated above.
   3. Sound Retardant Core: Equivalent to Type PC construction with core as required to achieve rating specified; plies and faces as indicated above.
C. Non-fire rated wood doors.
   1. Features:
      a. Thickness: 1-3/4 inches.
      b. Core: Solid.
      c. Facing Material:
         1) Wood veneer facing with factory transparent finish.
         2) Wood veneer facing with factory opaque finish.
         3) High pressure decorative laminate finish.
      d. Color/Finish: To be selected from manufacturer's full range.
      e. Glazed Lights: Sizes and configurations as indicated on drawings. Provide secure glazing stops on secure side of door.
D. Fire-rated wood 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. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with International Building Code ("positive pressure"); UL or WH (ITS) labeled without any

visible seals when door is open.

2. Features:
   a. Thickness: 1-3/4 inches.
   b. Core: Fire rated as required to meet performance criteria.
   c. Facing Material:
      1) Wood veneer facing with factory transparent finish.
      2) Wood veneer facing with factory opaque finish.
      3) High pressure decorative laminate finish.
   d. Glazed Lights: Sizes and configurations as indicated on drawings. Provide secure glazing stops on secure side of door.
   e. Color/Finish: To be selected by Architect from manufacturer's full range.
   f. Glazed Lights: Sizes and configurations as indicated on drawings. Provide secure glazing stops on secure side of door.
      1) Glazing: In accordance with ICC (IBC)-2012 716 Tables.

E. Interior Smoke and Draft Control Doors:
   1. (Indicated as "S" on Drawings): Same construction as fire-rated doors with indicated fire rating, plus:
   2. Maximum Air Leakage: 3.0 cfm per sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
   3. Gasketing: No added gasketing or seals allowed.
   4. Label: UL "S" label.

F. Sound Rated Doors:
   1. (Indicated as SR on Drawings): Same construction as wood doors with indicated fire rating, plus:
   2. Performance Criteria:
      a. Sound Retardant Doors: Minimum STC of 45, calculated in accordance with ASTM E413, tested in accordance with ASTM E1408.

2.5 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.

2.6 FINISHING

A. Factory Finish: Finish work in accordance with AWI/AWMAC/WI (AWS) Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:
   1. Transparent:
      a. System - 11, Polyurethane, Catalyzed.
      b. Stain: To match sample.
      c. Sheen: Semigloss.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
B. Field-Finished Doors: Trimming to fit is acceptable.
   1. Adjust width of non-rated doors by cutting equally on both jamb edges.
   2. Trim maximum of 3/4 inch off bottom edges.
C. Coordinate installation of hardware.
D. Touch up damaged finishes.

3.3 TOLERANCES
- A. Conform to specified quality standard for fit and clearance tolerances.
- B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING
- A. Adjust and lubricate hardware for proper operation.
- B. Adjust for smooth and balanced door movement in accordance with manufacturer's instructions.

3.5 CLEANING
- A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.6 PROTECTION
- A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

3.7 SCHEDULE
- A. Refer to door schedule on drawings.

END OF SECTION

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Overhead coiling doors.

1.2 RELATED REQUIREMENTS
- A. 099000 - Painting and Coating: Field paint finish.
- B. 28 15 00 - Access Control Hardware: For card readers and RFID controls.

1.3 SUBMITTALS
- A. Qualification Data: For manufacturer.
- B. Product Data: Provide general construction, component connections and details, electrical equipment .
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Sample: Submit two slats, 6 inch in length illustrating shape, color and finish texture.
- E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention. Indicate installation sequence and procedures, adjustment and alignment procedures
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Data: For user's 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. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.
  4. Recommendations on maintenance schedule.

1.4 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.

1.5 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.

PART 2 PRODUCTS

2.1 DESCRIPTION
- A. Fire rated and Non-rated overhead coiling doors.

2.2 PERFORMANCE AND DESIGN CRITERIA
- A. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

2.3 MATERIALS
- A. Overhead coiling doors.
  1. Low Headroom overhead coiling doors:
     a. Specification is based on Spiral LZ Low Headroom door by Rytec High Performance Doors.
     b. Performance Criteria:
        1) Accommodate dimensions and head heights indicated on drawings and scheduled below.
        2) High Cycle: Rated by manufacturer for 200,000 cycles on all components.
     c. Features:

1) Curtain Material: Aluminum slats, with vents for maximum air flow.
2) Material Thickness: As required by manufacturer for heavy duty door of size indicated.
3) Curtain Finish: Manufacturers typical aluminum finish.
   (a) Color: Architect to choose from full line of manufacturer's colors.
4) Hood: Match the material, finish and color of curtain.
5) Operation: Electric motor operated.
6) Mounting: Face of wall.
7) Travel Speed: Adjustable, through control box, and factory-set to open at 30 inches per second and close at 30 inches per second.
8) Release Mechanism: Security badge operation and wall mounted control box.
9) Safety Edge: Located at bottom of curtain, full width, wired to stop operator upon striking object.
10) Lock/Latch: None.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
B. Install and test all fire doors in accordance with NFPA 80

3.4 ADJUSTING

A. Adjust and lubricate hardware for proper operation.

3.5 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.6 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

3.7 SCHEDULE

A. Refer to plans and door schedule for locations and types.

END OF SECTION

SECTION 085413 - FIBERGLASS WINDOWS AND DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Fixed and Casement Fiberglass windows.

1.2 RELATED REQUIREMENTS
- A. 079005 - Joint Sealers: Perimeter sealant and back-up materials.

1.3 SUBMITTALS
- A. Qualification Data: For manufacturer, installer, and design engineer.
- B. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements and indicate required flashings and sealing requirements at openings.
- D. Samples: Submit two samples of 6 inch long samples illustrating frame section. Submit two samples of all accessories and operating hardware.
- E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Data: For user's 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.

1.4 MAINTENANCE MATERIAL
- A. 3 sets of operating hardware.

1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.6 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.

1.7 WARRANTY
- A. Provide 10 year manufacturer warranty for window units, and replacement of same.
- B. Provide 20 year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 PRODUCTS

2.1 DESCRIPTION
- A. Factory fabricated fiberglass windows including operating hardware, glazing and accessories.

2.2 PERFORMANCE AND DESIGN CRITERIA
- A. Positive and Negative Design Wind Load: In accordance with general notes.
- B. 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.

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.

C. U-Value: Per window schedule.

D. Air Infiltration:
1. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.04 cfm/sq. ft. of fixed wall area as determined according to ASTM E283 at a minimum static-air-pressure differential of 8.3 lbf/sq. ft.

E. Water Leakage:
1. No evidence of water leakage per ASTM E331 at 8.3 psf.
2. The appearance of any water on the interior side of any part of the glazed wall assembly, including the interface locations with adjacent envelope systems, that is not contained and drained back to the exterior, or that can cause damage to adjacent materials or finishes. Water fully contained in drained flashings, gutters, and sills is not considered water penetration.

F. Condensation Resistance:
1. Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

G. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.
2. Test Interior Ambient-Air Temperature: 75 degrees 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.

2.3 MATERIALS

A. Fixed and Casement Fiberglass Windows:
1. Manufacturer: Pella Impervia Fiberglass Windows.
2. Features:
    a. Glazing: Dual-pane insulating glass.
    b. Gass Fill: Argon.
    c. Reinforcing: As required to meet performance criteria and opening sizes indicated.
    d. Dimensions and Configurations: As indicated.
    e. Casement and Awning Hardware:
        1) Color: Match existing.
    f. Sliding Single & Double-Hung Lock:
        1) Lock: Cam-Action.
        2) Color-Matched Finishes.
    g. Sash Locks: Self-aligning sash lock.
    h. Grilles:
        1) Aluminum grilles between the glass.
        2) Contoured: 3/4-inch.
        3) Color: Match existing.

2.4 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.4 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

3.5 ADJUSTING

A. Adjust and lubricate hardware for proper operation.

3.6 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.7 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 085659 - TRANSACTION WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Transaction Windows.

1.2 RELATED REQUIREMENTS
- A. 064100 - Architectural Wood Casework: For casework supporting countertops.

1.3 ADMINISTRATIVE REQUIREMENTS
- A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013100 - Project Management and Coordination.
  1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.4 SUBMITTALS
- A. Qualification Data: For manufacturer, design engineer, fabricator, and installer.
- 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: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.
- D. Shop Drawings: Indicate extents, special joint or termination conditions, and conditions of interface with other materials.
- E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Data: For user's 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.

1.5 MAINTENANCE MATERIAL
- A. Spare parts, extra stock, tools.

1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.
- B. Fabricators Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.

1.7 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.

1.8 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

2.1 DESCRIPTION
- A. Factory fabricated and finished aluminum framed transaction windows with deal trays, glass infill, and related flashings, anchorage and attachment devices.

2.2 MATERIALS
- A. Horizontal Sliding Service Window.

B. Manufacturer: C.R. Laurence Architectural Products.
   1. Substitutions for products by manufacturers other than those listed above: See Section 016000 - Product Requirements.
C. Features:
   1. Product: SW1800 No Screen.
   2. Material: Extruded aluminum 6063-T6 Frame.
   3. Finish: Satin anodized.
   4. Glazing: 1/4-inch tempered glass.
   5. Side-by-Side installation for vertical mullion supplied by others to separate windows.
   6. Full bottom track with supporting wheels.

2.3 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.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION
A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION
A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.4 ADJUSTING
A. Adjust and lubricate hardware for proper operation.

3.5 CLEANING
A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.6 PROTECTION
A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Locks and latches.
B. Hinges.
C. Gasketing and thresholds.
D. Finishes.

1.2 RELATED REQUIREMENTS

A. 081113 - Hollow Metal Doors and Frames.

1.3 SUBMITTALS

A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.
B. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.
C. Keying Schedule: Submit for approval of Owner.
D. Prior to preparation of hardware schedule:
    1. Submit one (1) sample of hinge, latchset, lockset, and closer illustrating style, color, and finish.
    2. Samples will be returned to supplier.
E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
G. Maintenance Data: For user operation and maintenance of system including:
    1. Manufacturer's parts lists and templates.
    2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.
    3. Bitting List: List of combinations as furnished.
H. Closeout Submittals: Deliver keys with identifying tags to Owner by security shipment direct from hardware supplier.
I. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

1.4 MAINTENANCE MATERIAL

A. Extra Lock Cylinders: Ten for each master keyed group.
B. Tools: One set of all special wrenches or tools applicable to each different or special hardware component, whether supplied by the hardware component manufacturer or not.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum of 5 years of experience.

1.6 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.
B. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

PART 2 PRODUCTS

2.1 DESCRIPTION
- A. Mechanical hardware for swinging doors, sliding doors and gates, to match existing.

2.2 PERFORMANCE AND DESIGN CRITERIA
- A. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's 2010 ADA Standards for Accessible Design.
- C. Provide hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

2.3 LOCKS AND LATCHES
- A. Match existing.

2.4 HINGES
- A. Match existing.

2.5 GASKETING AND THRESHOLDS
- A. Gaskets: Complying with BHMA A156.22.
  1. On each exterior door, provide weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles of pairs.
     a. Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.
  2. On each exterior door, provide door bottom sweep, unless otherwise indicated.
- B. Thresholds: Complying with BHMA A156.21.
  1. At each exterior door, provide a threshold unless otherwise indicated.
  2. Field cut threshold to frame for tight fit.

2.6 FINISHES
- A. Provide finishes complying with BHMA A156.18.

2.7 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.

PART 3 EXECUTION

3.1 EXAMINATION
- A. Verify existing conditions meet the manufacturer's requirements before starting work.
- B. Verify that doors and frames are ready to receive work; labeled, fire rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

3.2 PREPARATION
- A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION
- A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
- B. Use templates provided by hardware item manufacturer.
- C. Do not install surface mounted items until finishes applied to substrate are complete.
- D. Install hardware on fire rated doors and frames in accordance with code and NFPA 80.
- E. Mounting heights for hardware from finished floor to center line of hardware item.
  1. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
  2. For Wood Doors: Comply with DHI "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- F. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel

countersunk screws.

3.4 ADJUSTING

A. Adjust and lubricate hardware for proper operation.

3.5 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

B. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality.

3.6 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 088003 - INTERIOR GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Delegated design of interior monolithic glazing.
B. Glass glazing.
C. Glazing films.

1.2 RELATED REQUIREMENTS

A. 085413 - Fiberglass Windows and Doors: For assembly requiring components from this section.

1.3 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 user's 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.

1.4 QUALITY ASSURANCE

A. Fabricators Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.5 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.

1.6 WARRANTY

A. Sealed Insulating Glass Units: Provide a ten (10) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
B. Laminated Glass: Provide a ten (10) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Interior Glazing and accessories installed as monolithic glazing.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
B. Roll Wave Maximum Distortion Tolerance: 0.003 inch target with 0.005 inch maximum peak to valley measurement.
C. Bow and Warp Maximum Tolerance: 50 percent of the maximum allowed in ASTM C1048.
D. Thickness: As required for loads indicated.
E. Deflection no greater than 1/175 of the longest dimension or 1/2 inch which ever is less.

2.3 MATERIALS

A. Insulating Glazing Units:
    1. Fabricator:
        a. Any of the manufacturers specified for float glass.
        b. Any fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified performance, features and warranty.
    2. Sealed Insulating Glass Units:
        a. Performance:
            1) Durability: Certified by an independent testing agency to comply with ASTM E2190.
            2) Edge Spacers: Material as required to meet performance criteria listed for assemblies.
                (a) Color: Black.
            3) Edge Seal: Glass to elastomer with supplementary silicone sealant.
                (a) Color: Black.
            4) Air Space: Hermetic air.
            5) U-Value: As required to meet performance criteria of complete assembly, not to exceed 0.24 Center of Glass.
B. (FILM-1) Glazing Film:
    1. Manufacturer: **3M FASARA**.
        a. Substitutions for products by manufacturers other than those listed: See Section 016000 - Product Requirements.
    2. Performance Criteria:
        a. Durable, dimensionally stable film designed for electro cut graphics.
        b. Adhesion 24 hours after application - Glass: 1.6 lb/in. (7.0 N/25 mm).
        c. Fire Resistance: ASTM E84.
    3. Features:
        a. Product: **Geometric SH2CHC**.
        b. Film: Polyester.
        c. Adhesive: Pressure-sensitive acrylic, permanent.
        d. Release Liner: Silicone-coated polyester.
        e. Thickness:
            1) Film + Adhesive: 3.3 mils.
            2) Release Liner: 1 mil.
        f. Maximum Roll Size: 60-inches x 98.4-feet.
        g. Light Transmittance: 55.
C. Accessories:
    1. Glazing Channels: Specification is based on CRL Wet Glaze U Channels by CRLaurence Co. Inc.

a. Comparable and substituted products will be judged based on the following performance criteria, features, warranty, and qualifications. See Section 016000 - Product Requirements for submittal requirements.
b. Features:
1) 1 inch deep base channel.
2) 2 inch deep top channel.
3) Finish: Satin Anodized.

2. Vertical Glazing Gasket: Specification is based on CRL EZ Glaze Soundstrip by CRLaurence Co. Inc.
a. Comparable and substituted products will be judged based on the following performance criteria, features, warranty, and qualifications. See Section 016000 - Product Requirements for submittal requirements.
b. Features:
1) Color: Clear
2) Depth: Selected to match glass panels.

2.4 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. Speak-Through Portal: Heavy duty, non-electric.
1. Basis of Design: CRL Satin Anodized Aluminum 5-5/16" No-Draft Speak Thru by C.R. Lawrence or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.4 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.5 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 092116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Gypsum Sheathing.
- B. Exterior Soffit Board.
- C. Gypsum Board.
- D. Tile Backer Board.
- E. Shaftwall.
- F. Acoustic Insulation.

1.2 RELATED REQUIREMENTS
- A. 054000 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
- B. 078400 - Firestopping: Top-of-wall assemblies at fire rated walls.
- C. 079005 - Joint Sealers: Acoustic sealant.
- D. 092219 - Non-Structural Metal Framing: Blocking product and execution requirements.

1.3 SUBMITTALS
- A. Qualification Data: For Installer and design engineer.
- B. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, joint finishing system, and cement board.
- C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- D. Test Reports: For all stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.4 QUALITY ASSURANCE
- A. Designer Qualifications: Professional structural engineer with 5 years of documented experience in design of this work and licensed in the location of the project.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.

1.5 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.

PART 2 PRODUCTS

2.1 DESCRIPTION
- A. Includes Gypsum wallboard finishing, metal trim and accessories, and acoustical sealants and insulation.

2.2 PERFORMANCE AND DESIGN CRITERIA
- A. Provide completed gypsum board assemblies complying with ASTM C840 and GA-216.
- B. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
  1. Air Pressure Within Shaft: Sustained loads of 7.5 lbf/sq ft with maximum mid-span deflection of L/240.
  2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Shaft Walls at Elevator and Stair Shafts: Provide completed assemblies with the following characteristics:
  1. Air Pressure Within Shaft: Intermittent loads of 7.5 lbf/sq ft with maximum mid-span deflection of L/240.
  2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

3. Soft Body Impact: Meet or exceed Soft Body Impact Classification Level 2 measured in accordance with ASTM C1629/C1629M.

D. Fire Rated Assemblies: Provide completed assemblies complying with UL listed assemblies indicated and ratings indicated on life safety drawings.
   1. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
   2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

E. Interior Partitions Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.3 MATERIALS

A. Gypsum Sheathing:
   1. Sizes to minimize joints in place; ends square cut.
      a. Application: Exterior sheathing, unless otherwise indicated.
      b. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      c. Glass-Mat-Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
   2. Core Type: Type X.
   3. Thickness: 5/8 inch.
   4. Basis of Design: Glass-Mat-Faced Products: Georgia-Pacific Gypsum; DensGlass Sheathing; CertainTeed Gypsum, Inc.

B. Impact-Resistant Gypsum Board:
   1. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1629/C1629, sizes to minimize joints in place; ends square cut.
      a. Application: Use as indicated.
      b. Type X: Thickness 5/8 inch.
      c. Edges: Tapered.
      d. Products:
         1) Georgia-Pacific Gypsum; ToughRock FireGuard X Abuse Resistant Gypsum Wallboard.
         2) CertainTeed Extreme Impact Resistant Gypsum Panels.
         3) National Gypsum; Hi-Impact XP Gypsum Wallboard.

C. Exterior Soffit Board:
   1. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
      a. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
      b. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
      c. Type X Thickness: 5/8 inch.
      d. Edges: Tapered.
      e. Products:
         1) Basis of Design: Georgia-Pacific Gypsum; ToughRock Soffit Board.

D. Gypsum Board:
   1. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

a. Application: Use for vertical surfaces, unless otherwise indicated.
b. Type X: Thickness 5/8 inch.
1) Edges: Tapered.
2) Products:
(a) Georgia-Pacific Gypsum; ToughRock, and ToughRock Fireguard.
(b) CertainTeed Gypsum, Inc.; GlasRoc.
c. Type C: Thickness: As indicated.
1) Edges: Tapered.
2) Products:
(a) ToughRock FireGuard C Gypsum Wallboard.
(b) CertainTeed Gypsum, Inc.; Type C Fire-Resistant Drywall.

E. Moisture Resistant Gypsum Board:
1. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
a. Application: Use at locations scheduled below, unless otherwise indicated.
b. Type X: Thickness 5/8 inch.
c. Edges: Tapered.
d. Products:
1) ToughRock Mold-Guard Gypsum Board by Georgia-Pacific Gypsum.

F. Tile Backer Board:
1. Glass-Mat-Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
a. Standard Type: Thickness 1/2 inch.
b. Fire-Resistant Type: Type X core, thickness 5/8 inch.
c. Products:
1) Georgia-Pacific Gypsum; DensShield Tile Backer.
2. ANSI Cement-Based Board:
a. Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
1) Thickness: 1/2 inch.
2) Products:
(a) Custom Building Products; Wonderboard.

G. Shaftwall and Coreboard:
1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
a. Application: Elevator shafts, stair cores and other assemblies that span floors.
b. Type X Thickness: 1 inch.
c. Edges: Beveled long edges and square cut ends.
d. Products:
1) Georgia-Pacific Gypsum; DensGlass Shaftliner (mold-resistant).

H. Acoustic Insulation:
1. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced.
Thickness: 3.5 inches, unless noted otherwise.

2.4 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. Acoustic Sealant:
1. As specified in Section 079005 - Joint Sealers.

C. Finishing Accessories:
   1. ASTM C1047, galvanized steel or rolled zinc, unless otherwise indicated.
      a. Types: As detailed or required for finished appearance.
      b. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.
D. Joint Materials:
   1. ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
      a. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
      b. Typical: Ready-mixed vinyl-based joint compound.
      c. Exterior Soffits: Chemical hardening type compound.
E. High Build Drywall Surfacer:
   1. Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
F. Anchorage to Substrate:
   1. Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION
A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION
A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
B. Comply with ASTM C840 and GA-216. Install to minimize butt end joints, especially in highly visible locations.
C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
D. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
E. Exterior Soffit Board: Install perpendicular to framing, with staggered end joints over framing members or other solid backing.
F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
G. All miscellaneous installation materials required to comply with EQ credit: Low Emitting Materials, in accordance with Section 013515 - LEED Certification Procedures.

3.4 INSTALLATION OF TRIM AND ACCESSORIES
A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   2. At exterior soffits, not more than 30 feet apart in both directions.
B. Corner Beads: Install at external corners, using longest practical lengths.
C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.5 JOINT TREATMENT
A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
    1. Level 5: Walls and ceilings typical.
    2. Level 4: Perforated gypsum.
    3. Level 4: For flat paint, a light final paint texture, or with lightweight wall covering.
    4. Level 3: In utility areas, behind cabinetry, and on backing board to receive tile finish.
    5. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
    6. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
    7. Level 0: Temporary partitions and surfaces indicated to be finished in later stage of project.
    8. Level 0: Surfaces indicated to be finished in later stage of project.
D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
    1. Feather coats of joint compound so that camber is maximum 1/32 inch.
E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.6 FIELD OBSERVATION AT "PUNCH"

A. Finish will be judged from a viewing difference of 4 feet.
B. Ceilings will be viewed from a standing position.
C. Finished lighting system or temporary lighting similar to proposed finished lighting should be used for judging the wall.
D. Eye catching discrepancies and or blemishes, including “fuzzy” wall board surfaces, will be rejected.

3.7 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.8 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

END OF SECTION

SECTION 092219 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Delegated design of non-structural metal framing.
B. Metal partition, ceiling, and soffit and shaftwall framing.
C. Blocking and backing panels.

1.2 RELATED REQUIREMENTS

A. 054000 - Cold-Formed Metal Framing: For structural load bearing metal stud framing.
B. 092116 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.

1.3 SUBMITTALS

A. Qualification Data: For 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. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
D. Shop Drawings: Indicate extents, special joint or termination conditions, and conditions of interface with other materials.
    1. Indicate acoustic details.
    2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.
E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.

1.5 MOCKUP

A. Mockup Size: Full height, minimum 12 feet long, including corner.
B. Mockup may remain as part of the Work.
C. The work of this section may be part of several different mockups. Coordinate with the mockups of other sections.

1.6 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.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Perform Work in accordance with ASTM C754.
B. Coordinate the placement of components to be installed within stud framing system.
C. Suspended Assemblies: Coordinate with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive

hangers at spacing required to support the Work and that hangers will develop their full strength.

D. Design and install framing and furring to limit deflection to the following under point loads of 100 lbs and uniform loads as noted below except where required to withstand greater load (pressurized shafts and stairwells for example).
   1. Maximum Deflection of Vertical Assemblies:
      a. Assemblies spanning single floor: Sustained loads of 5 lbf/sq ft with a maximum mid span deflection of 1:240.
      b. Assemblies spanning multiple floors: Sustained loads of 7.5 lbf/sq ft with a maximum mid span deflection of 1:240.
   2. Maximum Deflection of Horizontal Assemblies: 1:240 deflection under dead loads and wind uplift.
   3. Maximum Deflection for assemblies under applied plaster finishes (Portland Cement or Gypsum) and ceramic tile is 1:360.
   4. Use The SSMA Product Technical Information Book to look up the appropriate stud size, spacing and thickness.

E. Ceiling and Soffit Framing:
   1. Seismic Requirements:
      a. Classification: Conform to ASTM C635/C635M, Heavy Duty Classification.
      b. Code Compliance: FBC, American Society of Civil Engineers ASCE 7 Section 13 and CISCA (AC) Guidelines.

F. Acoustic Attenuation for Interior Partitions : STC's are calculated in accordance with ASTM E413 and based on published tests conducted in accordance with ASTM E90.
   1. Provide materials and construction identical to those tested in assembly indicated according to ASTM E90. See Section 092116 for STC requirement.

G. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

2.3 MATERIALS

A. Metal partition, ceiling, and soffit and shaftwall framing.
   1. Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and "SSMA Product Technical Information" book for the spacing indicated<>.
      a. Minimum Framing Component thickness is 20 Gage.
      b. Studs: C shaped.
      c. Runners: U shaped, sized to match studs.
      d. Ceiling Channels: C shaped or T shaped.
      e. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
      f. Steel Stud Framing Connectors:
         1) Products:
            (a) Simpson Strong Tie, Bridging Connectors; DBC Bridging Connector: www.strongtie.com.
      g. Single leg Resilient channels.
      h. "Z's": Used for several different members.
      i. Shaftwall framing CH and other sections as required for complete framing system.
   2. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   3. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing

rotation of studs while maintaining structural performance of partition.

a. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
b. Material:
    1) Typical: ASTM A653/A653M steel sheet, SS Grade 50, with G40/Z120 hot dipped galvanized coating.
    2) Areas Subject to Moisture: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot dipped galvanized coating. Areas include exterior or non-conditioned space, shower rooms, locker rooms or other locations subject to regular wetting or high humidity.
c. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems.

4. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.
5. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.
6. Fasteners: ASTM C1002 self-piercing tapping screws.
7. Anchorage Devices: Power actuated.
    a. Also acceptable "Danback" flexible wood blocking system from Deitrich.
    b. See backing schedule on architectural drawings.
8. Anchorage Devices: Power actuated or Drilled expansion bolts.
9. Acoustic Insulation: As specified in Section 092116 - Gypsum Board Assemblies.
10. Acoustic Sealant: As specified in Section 079005.
11. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

B. Blocking and backing panels.
1. Sheet Metal Backing (Blocking): 0.036 inch thick, galvanized. 4 inch minimum width
    a. See backing schedule on architectural drawings.
2. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
3. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
4. Specifically, provide the following non-structural framing and blocking:
    a. Cabinets and shelf supports.
    b. Wall brackets.
    c. Handrails.
    d. Grab bars.
    e. Towel and bath accessories.
    f. Wall-mounted door stops.
    g. Chalkboards and marker boards.
    h. Wall paneling and trim.
    i. Joints of rigid wall coverings that occur between studs.

2.4 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that rough-in utilities are in proper location.
C. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION OF STUD FRAMING

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
B. Comply with requirements of ASTM C754.
C. Extend partition framing to structure where indicated and to ceiling in other locations.
D. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
E. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
F. At partitions indicated with an acoustic rating:
    1. Provide components and install as required to produce STC ratings as indicated.
    2. Place two beads of acoustic sealant (one on either side) between runners and substrate, studs, and adjacent construction.
    3. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.
    4. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
H. Backing and Blocking: Use steel channels or flat sheets secured to studs minimum 4" wide. Provide blocking for support of all wall hung items and equipment.
    1. Use sheet metal backing for reinforcement of 16 gauge minimum.
I. Install supplementary framing and bracing at openings and terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer.
J. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement:
    1. Where edges of suspended ceilings abut building structure at ceiling perimeters and at penetrations of structural elements.
    2. Where partition and wall framing abuts overhead structure.
    3. Where studs are installed directly against exterior walls of masonry or concrete, install asphalt felt strips between studs and wall.

3.4 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.
B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
C. Install furring independent of walls, columns, and above-ceiling work.
D. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.
H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
I. Laterally brace suspension system.
    1. Sway-brace suspension systems with hangers used for support.

3.5 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.
B. Maximum Variation From Plumb: 1/8 inch in 10 feet.
C. Level ceiling to a tolerance of 1/1200. For tilted ceilings maintain this tolerance as a "flatness" tolerance.

3.6 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.7 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 095100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Acoustical units.

1.2 SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, mechanical and electrical items installed in the ceiling, and perimeter molding and suspension/bracing details.

C. Product Data: Provide data on suspension system components, acoustical units, and perimeter molding/seismic connections.

D. Samples: Submit two samples 48 x 48 inch in size illustrating material and finish of acoustical units.

E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Data: For user's 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.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum of 5 years of experience.

1.4 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.

1.5 WARRANTY

A. Provide 10 year manufacturer warranty on all acoustical panels for sagging and warping, grid system, rusting, and manufacturer's defects.

B. Provide 15 year warranty for all products using additional "Humidity and Sag resistance" control systems.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Acoustic ceiling tile to match existing. Suspended metal grid ceiling systems with seismic edge clips and manufactured edge trim at changes in plane.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Seismic Requirements:

1. Classification: Conform to ASTM C635/C635M, Heavy Duty Classification.
2. Code Compliance: IBC, American Society of Civil Engineers ASCE 7, and CISCA (AC) Guidelines. Comply with edition dates per local Authorities Having Jurisdiction.

B. Components: Lock together in a positive manner.

C. Pull out tension:

1. Cross Tee Connections: Minimum 300 pounds.
2. Main Tee Splices: Minimum 200 pounds.

D. Seismic Lateral Design: Conform to IBC and ASCE 7 especially requirement for independent support from structure above for light fixture and mechanical services installed into acoustical lay-in panel ceiling systems.

E. Install to conceal plenum space above acoustical ceiling system and to allow access.
F. Make provisions for vertical as well as horizontal suspension systems.

2.3 MATERIALS
A. (ACT-1) Acoustical Units - General: ASTM E1264, Class A.
1. Features: Match existing.

2.4 SUSPENSION SYSTEM(S)
A. Manufacturers:
1. Same as for acoustical units.
2. Substitutions: See Section 016000 - Product Requirements.
B. Suspension Systems - General: ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

2.5 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.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify existing conditions meet the manufacturer's requirements before starting work.
B. Verify that layout of hangers will not interfere with other work.

3.2 PREPARATION
A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION
A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
B. Patch, infill and repair to match existing tile.
1. _____
2. _____

3.4 TOLERANCES
A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.5 CLEANING
A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.6 PROTECTION
A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

END OF SECTION

SECTION 096500 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient sheet flooring.
B. Resilient base.

1.2 RELATED REQUIREMENTS

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013100 - Project Management and Coordination.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.4 SUBMITTALS

A. Qualification Data: For installer.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Shop Drawings: Indicate seaming plan.
D. Flooring Sample: Submit two samples, 6 x 6 inch in size illustrating color and pattern for each resilient flooring product specified; heat weld rod samples for selection.
E. Base and Accessory Samples: Submit manufacturer's complete set of color samples for initial selection.
F. Certificate: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
G. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
I. Maintenance Data: For user's 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 maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.5 MAINTENANCE MATERIAL

A. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Flooring Material: 50 square feet of each type and color.
   2. Extra Wall Base: 20 linear feet of each type and color.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum 2 years of experience.

1.7 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.

1.8 WARRANTY

A. Provide minimum Manufacturers Limited 5 year commercial warranty for manufacturing defects.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Resilient sheet flooring, resilient base and installation accessories for transition to other flooring types.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.

2.3 RESILIENT SHEET FLOORING

A. (RES-2) Linoleum Sheet Flooring: 100 percent virgin composition, color and pattern through total thickness.
   1. Manufacturer: Forbo.
      a. Substitutions for products by manufacturers other than those listed: See Section 016000 - Product Requirements.
   2. Performance Requirements:
      a. Homogenous sheet good.
      b. Minimum Requirements: Comply with ASTM F1913 without backing.
      c. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   3. Features:
      a. Product: Marmoelum-Piano.
      b. Color: 3601 Warm Grey.
      c. Total Thickness: 0.079 inch minimum.
      d. Roll Size: 79 inch minimum.
   4. Seamless Installation: Per manufacturer's non-heat welded adhesives.

2.4 RESILIENT BASE

A. (RES-1) Resilient Base: ASTM F1861, top set Style A straight, and as follows:
   1. Manufacturer: ROPPE.
   2. Features:
      a. Product: Pinnacle.
      b. Profile: 4-inch with toe.
   3. Thickness: 0.125 inch thick.
   4. Color: 123 Charcoal.
   5. Finish: Satin.
   6. Length: Roll (4 foot sections are not acceptable except as maintenance stock).
   7. Seamless Installation: Per manufacturer's non-heat welded adhesives.

2.5 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. Subfloor Filler:
   1. White premix latex; type recommended by adhesive material manufacturer.

C. Primers, Adhesives, and Seaming Materials:
   1. Waterproof; types recommended by flooring manufacturer.

D. Moldings, Transition and Edge Strips:
   1. Manufacturer: Roppe Corporation.
   2. Product: #32 Half Threshold.
   3. Color: Match existing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

B. Verify existing conditions meet the manufacturer's requirements before starting work, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
C. Verify that wall surfaces are smooth and flat within the tolerances specified, are dust-free, and are ready to receive resilient base.
D. Cementitious Subfloor Surfaces: Verify that substrates meet moisture, internal relative humidity and alkalinity requirements of flooring and adhesive manufacturers in accordance with Section 090510 - Flooring Moisture Measurement and Mitigation.
    1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General:
    1. Install all materials in accordance with manufacturer's instructions based on conditions present.
    2. Starting installation constitutes acceptance of subfloor conditions.
    3. Fit joints tightly.
    4. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
    5. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
        a. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
        b. Resilient Strips: Attach to substrate using adhesive.
    6. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
    7. Install flooring in recessed floor access covers, maintaining floor pattern.
    8. At movable partitions, install flooring under partitions without interrupting floor pattern.
    9. Turn sheet flooring up 4 inches to create integral cove base. Heat weld corner seams.

3.4 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.
B. Remove excess adhesive from floor, base, and wall surfaces without damage.
C. Initial cleaning and finishing is the responsibility of the contractor.
    1. Follow manufacturer's recommendations for initial cleaning and finishing procedures.
    2. Not all types of flooring require finishing.

3.5 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 096813 - TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Sheet carpet.

1.2 SUBMITTALS
- A. Qualification Data: For installer.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate layout of joints.
- D. Flooring Sample: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Accessory Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- F. Certificate: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- G. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- I. Maintenance Data: For user's operation and maintenance of materials including:
  1. Methods for maintaining materials and finishes.
  2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.
  3. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.3 MAINTENANCE MATERIAL
- A. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. Extra Flooring Material: 3 percent of each type and color (minimum of 10 yards) each type and color.

1.4 QUALITY ASSURANCE
- A. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

1.5 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.

1.6 WARRANTY
- A. Provide minimum Manufacturers Limited 5 year commercial warranty for manufacturing defects.

PART 2 PRODUCTS

2.1 DESCRIPTION
- A. Carpeting installed fully adhered.

2.2 PERFORMANCE AND DESIGN CRITERIA
- A. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
- B. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").

2.3 CARPET TILE
- A. Carpeting:
  1. (CPT-1) Manufacturer: Interface.
  2. Performance:

a. Flooring Radiant Panel: (ASTM E-648).
b. Smoke Density: (ASTM E 662) ≤ 450.
c. Flammability: Passes Methenamine Pill Test (DOC-FF1-70).
d. Lightfastness: (AATCC 16 - E) ≥ 4.0 @ 60 AFU's.
e. Traffic Classification: Heavy.
f. Material Composition: Free of Added Heavy Metals, Ortho Phthalates, Formaldehyde, Fluorinated Chemicals (PFAS), and Halogenated Flame Retardants.

3. Features:
a. Product: CT111.
b. Collection: Common Theme.
c. Color: 104343 Slate.
d. Size: 9.845-inches x 39.38-inches.
e. Standard Backing: GlasBac.
f. Construction: Tufted textured loop.
g. Yarn System: Post-Consumer Content Nylon.
h. Dye Method: 100% solution dyed.
i. Preservation Protection: Protekt.
j. Installation Method: Ashlar. See manufacturer's installation guidelines.

B. (CPT-2) Manufacturer: Interface**.**
1. Performance Criteria:
a. Flooring Radiant Panel: (ASTM E-648).
b. Smoke Density: (ASTM E 662) ≤ 450.
c. Lightfastness: (AATCC 16 - E) ≥ 4.0 @ 60 AFU's.
d. Dimensional Stability: AACHEN Din 54318 <.10%.
e. Traffic Classification: Moderate.
2. Features:
a. Product: Flor.
b. Color: 603059 Antracite.
c. Size: 19.69-inches x 19.69-inches.
d. Backing: GRAPHLAR.
e. Yarn System: 55% Nylon; 27.5% Animal Hair; 17.5% Polyester.
f. Installation: See manufacturer's installation guidelines.

2.4 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. Subfloor Filler: Type recommended by adhesive material manufacturer.
C. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.
D. Moldings, Transition and Edge Strips: 096500 - Resilient Flooring.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify existing conditions meet the manufacturer's requirements before starting work, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
B. Cementitious Subfloor Surfaces: Verify that substrates meet moisture, internal relative humidity and alkalinity requirements of flooring and adhesive manufacturers in accordance with Section 090510 - Flooring Moisture Measurement and Mitigation.

1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

C. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General:
1. Install all materials in accordance with manufacturer's instructions based on conditions present and CRI Carpet Installation Standard.
2. Blend carpet from different cartons to ensure minimal variation in color match.
3. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
4. Lay carpet tile in pattern scheduled in Finish Legend on Drawings, with pile direction parallel to next unit, set aligned as indicated on shop drawings.
5. Starting installation constitutes acceptance of subfloor conditions.
6. Fit joints tightly.
7. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
8. Adhere carpet tile to substrate along centerline of rooms, at perimeter of rooms, where tiles are cut, and at 15 foot intervals throughout rooms. Lay remainder of tile dry over substrate.
9. Trim carpet tile neatly at walls and around interruptions.
10. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
a. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
b. Resilient Strips: Attach to substrate using adhesive.

3.4 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.
B. Clean and vacuum carpet tile surfaces in accordance with manufacturer's instructions.
C. Dispose of all waste material in accordance with project's Waste Management Plan.

3.5 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 097200 - WALL COVERING

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Wall Covering.

1.2 RELATED REQUIREMENTS
- A. 092116 - Gypsum Board Assemblies: for requirements of level 5 gypsum substrate.
- B. 099000 - Painting and Coating: Preparation and priming of substrate surfaces.

1.3 SUBMITTALS
- A. Qualification Data: For manufacturer and installer.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Sample: Submit two samples of wall covering, 6 x 6 inch in size illustrating color, finish, and texture.
- E. Accessory Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- F. Certificate: Prior to installation of wall covering, submit written certification by flooring manufacturer and adhesive manufacturer that condition of substrate is acceptable.
- G. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- I. Maintenance Data: For user's operation and maintenance of materials including:
  1. Methods for maintaining materials and finishes.
  2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.
  3. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.4 MAINTENANCE MATERIAL
- A. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. Extra Wall Covering Material: 100 square feet of each type and color.

1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

1.6 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.

1.7 WARRANTY
- A. Provide minimum Manufacturers Limited 5 year commercial warranty for manufacturing defects.

PART 2 PRODUCTS

2.1 DESCRIPTION
- A. Roll stock tackable wall coverings adhered to substrate.

2.2 PERFORMANCE AND DESIGN CRITERIA
- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

B. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.

2.3 WALL COVERING

A. **(WC-1)** Tackable Wall Covering: Uni-color resilient homogeneous tackable linoleum surface consisting of linseed oil, granulated cork, rosin binders, and dry pigments calendered onto natural burlap backing. Color shall extend through thickness of material.

B. Manufacturer: **Tac-Wall by Walltalkers**.

1. Substitutions for products by manufacturers other than those listed above: See Section 01 60 00-Product Requirements.

C. Features:

1. Width: 48-inches.
2. Gauge: 1/4-inch.
3. Rolls: 95 lineal feet.
4. Backing: Burlap.
5. Color: Stone 04.

2.4 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. J-Trim for Tac-Wall:

1. Product: **JT12-00**: clear satin, anodized aluminum, 1/4-inch trim.

C. Substrate Filler:

1. As recommended by adhesive and wall covering manufacturers; compatible with substrate.

D. Primers, Adhesives, and Seaming Materials:

1. Waterproof; types recommended by wall covering manufacturer.
2. Tac-Wall Adhesive: Solvent-free, SBR type linoleum adhesive (L-910W) or polyvinyl acetate dispersion type (contact adhesive) when used in a press.
   a. Color Matched Caulk: _____

E. Termination Trim:

1. Extruded plastic, clear.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are finished to gypsum Level 5 in accordance with Section 092116, prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

D. Verify that required wall-mounted accessories are in correct location.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

B. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

3.3 INSTALLATION

A. General:

1. Install all materials in accordance with manufacturer's instructions based on conditions present.
2. Use wall covering in roll number sequence.
3. Horizontal seams are not acceptable.
4. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
5. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
6. Do not install wall covering more than 1/4 inch below top of resilient base.
7. Cover spaces above and below windows, above doors, in pattern sequence from roll.
8. Apply wall covering to electrical wall plates prior to replacing.
9. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.4 CLEANING

A. Remove excess adhesive from floor, and wall surfaces without damage.
B. Clean and vacuum carpet tile surfaces in accordance with manufacturer's instructions.
C. Dispose of all waste material in accordance with project's Waste Management Plan.

3.5 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 099000 - PAINTING AND COATING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior Painting System by Substrate.
B. Surface Preparation for Field-Applied Painting and Coating.

1.2 RELATED REQUIREMENTS

A. 014339 - Mockups: For additional requirements related to the mockups in this section.
B. 016000 - Product Requirements: For substitution and additional product requirements.
C. 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
D. 064100 - Architectural Wood Casework: For finishing of wood casework.
E. 092116 - Gypsum Board Assemblies: For finish levels required of substrates.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Surface Preparation Meeting: Convene within 30 days of paint scope award:
   1. Agenda items:
      a. Review surface preparation plan.
      b. Review proposed specialty surface preparation techniques.
B. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013100 - Project Management and Coordination.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.4 SUBMITTALS

A. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.
B. Substrate Preparation Plan:
   1. Cleaning sample area selection.
   2. Preparation and execution including pollution control and safety procedures.
   3. Coordination with other Work.
   4. Proposed cleaning and restoration methods:
      a. Submit a descriptive narrative on cleaning and restoration methods to be employed in the Work. Organize description in sequence from preparation through completion of the Work. Include a schedule showing estimated time, in calendar days, for completion of each phase of the Work shall be included.
      b. Submit the cleaning and restoration methods, tools, and materials selected for each specific material, take into account adjacent materials, assemblies and location of the area to be worked upon when selecting cleaning materials and procedures.
C. Shop Drawings: Include annotated architectural drawing indicating scope and location of:
   1. Existing substrates to be cleaned and painted or coated.
   2. Exposed Overhead Work and Open to Structure areas to receive painting or coating.
D. Sample: Submit three cardstock "draw down" samples, 8.5 x 11 inch in size, including standard and custom paint color formula and availablility information, illustrating range of color and texture available for each surface finishing product scheduled.
E. Matching Finishes:
F. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
G. Maintenance Data: For user's operation and maintenance of system including:
   1. Methods for maintaining finishes.

2. Precautions about cleaning materials and methods that could be detrimental to finishes, and performance.
3. Recommendations on maintenance schedule.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.6 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.
B. Store, mix, apply and dispose of paint related materials in accordance with requirements of Authorities Having Jurisdiction.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Field-applied painting and coatings and substrate preparation.

2.2 GENERAL

A. Provide all paint and coating products used in any individual system from the same manufacturer, unless noted otherwise below.
B. Sheen, unless otherwise noted:
1. Walls: Eggshell.
2. Ceilings: Flat.
3. Standing and running trim: Semi-Gloss.
C. Surfaces to paint:
1. Interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

2.3 MANUFACTURERS

A. Paints:
1. **S-W:** Sherwin-Williams Co.; www.sherwin-williams.com.
B. Transparent Coatings:
1. **S-W:** Sherwin-Williams Co.; www.sherwin-williams.com.

2.4 INTERIOR PAINTING SYSTEM BY SUBSTRATE

A. Aluminum
1. Acrylic:
a. **PPG:**
1) Primer: 90-712 Series Pitt-Tech Int/Ext DTM Industrial Primer; 2.0-3.0 mils dft.
2) Topcoat: 4216 Series Pitt-Tech Plus HP/Devflex 4216 HP Semi-Gloss; 1.5 - 4.0 mils dft.
b. **S-W:**
1) Primer: Pro Industrial Pro-Cryl Universal Primer B66-1310 Series; 1.9 mils dft.
2) Topcoat: Pro Industrial Eg-Shel Acrylic, B66-660 Series; 2.2 mils dft.
B. Ferrous Metal:
1. Acrylic:
a. **B-M:**
1) Primer: Ultra Spec Acrylic DTM Primer HP04; 1.7 - 2.3 mils dft.
2) Topcoat: Ultra Spec Acrylic DTM Gloss HP29; 2.3 mils dft.
b. **K-M:**

1) Primer: 5725 Acrylic Primer; 1.5-2.2 mils dft.
2) Top Coat: 5885 Acrylic DTM; 1.6-2.3 mils dft.

c. **MPC:**
1) Primer: Acrimetal 3102 Int./Ext DTM Acrylic Primer; 1.5 mils dft.
2) Top Coat: Acrimetal 3104 Satin Int./Ext DTM Acrylic; 2.3 mils dft.

d. **PPG:**
1) Primer: 4020PF Series Pitt-Tech Plus Primer/Finish; 2.2-3.5 mils dft.
2) Topcoat: 4216 Series Pitt-Tech Plus HP/Devflex 4216 HP Semi-Gloss; 1.5 - 4.0 mils dft.

e. **R-C:**
1) Primer: EcoLogic Shop Primer 7032 Series; 2.0 mils dft.
2) Topcoat: Protech MultiMaster VST Acrylic Urethane Semi-Gloss 4489 Series; 1.7 mils dft.
3) Alternative Topcoat: Protech Pre-Catalyzed Epoxy Semi-Gloss 4490 Series; 1.5-2.0 mils dft.

f. **S-W:**
1) Primer: Pro Industrial Pro-Cryl Universal Primer B66-1310 Series; 1.9 mils dft.
2) Topcoat: Pro Industrial Eg-Shel Acrylic, B66-660 Series; 2.2 mils dft.

C. Gypsum Board
1. Acrylic-Enamel; two coats over primer:

a. **B-M:**
1) Primer: Ultra Spec Primer N534; 1.4 mils dft.
2) Topcoat: Ultra Spec 500 Interior Enamel Series; 1.8 mils dft.

b. **K-M:**
1) Primer: Acryplex 971 PVA Primer Sealer; 1.4mils dft.
2) Topcoat: Premium Professional 1010 Eggshell; 1.5 mils dft.

c. **MPC:**
1) Primer: MPI 50 PVA Primer Sealer; 1.4mils dft.
2) Topcoat: Performance-Plus Acrylic Eggshell; 1.5 mils dft.

d. **PPG:**
1) Primer: 17-921XI Series Seal Grip Int/Ext Acrylic Universal Primer/Sealer; 1.6 mils dft.
2) Topcoat: 9-110XI Series Pure Performance Interior 100% Acrylic Flat; 1.4-1.9 mils dft.
3) Topcoat: 9-310XI Series Pure Performance Interior 100% Acrylic Eggshell; 1.2-1.6 mils dft.
4) Topcoat: 9-510XI Series Pure Performance Interior 100% Acrylic Semi-Gloss; 1.3-1.7 mils dft.

e. **R-C:**
1) Primer: 503601 Master Painter UL VOC Interior Primer/Sealer; 1.5 mils dft.
2) Topcoats: 523501 Horizon Interior Acrylic Satin; 1.5 mils dft.
3) Alternative Topcoats: 573651 Master Painter HP Ultra Low VOC Acrylic Interior Eggshell; 1.5 mils dft.

f. **S-W:**
1) Primer: PrepRite ProBlock Interior Latex Primer, B51-600 Series; 1.4 mils dft.
2) Primer: ProMar 200 Zero VOC Primer B28 Series; 1.5 mils dft.
3) Topcoat: Duration Home Interior Latex Satin, A97-1200 Series; 1.6 mils dft.

4) Alternate Topcoat: ProMar 200 HP Zero VOC Latex Eg-Shel, B20-1900 Series; 1.7 mils dft.

2.5 ACCESSORIES

A. Material for patching and concealing fastener heads: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate surfaces are ready to receive work to include the removal or protection of adjacent materials not to be painted and cleaning to remove particulate or residues that are incompatible or may impact the bonding capability of the coating.

B. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance.

C. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent, and fully cured.

3.2 SURFACE PREPARATION BY SUBSTRATE

A. Metal:

1. Aluminum:
   a. Clean and remove loose surface oxidation. Mechanically abrade or abrasive blast in accordance with SSPC-SP 16 guidelines to achieve suitable anchor profile for material specified. Size and hardness of abrasive should be adjusted as necessary based on the hardness of the substrate and anchor profile desired for adhesion.
   b. Aluminum may be treated with a surface treatment compliant with Mil-DTL-5541 or equivalent (non-immersion applications only).
2. Ferrous Metal:
   a. Solvent clean according to SSPC-SP 1.
   b. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   c. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer or blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
3. Shop-Primed Steel: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
4. Galvanized Metal:
   a. Clean metal to remove oils, contaminates with detergent, emulsion cleaner or other appropriate means per SSPC-SP 1.
   b. A light abrasive blast performed per SSPC-SP-16 is preferred. If this is not feasible, then abrade the surface by means of hand tool per SSPC-SP 2, or power tool per SSPC-SP 3, to achieve clean, roughened profile suitable for adhesion.

B. Wood:

1. Wood Substrate, General:

a. Wash with a detergent solution, rinse thoroughly with clean water, and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
b. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

2. Wood for Opaque Coatings:
   a. Interior Wood:
      1) Scrape and clean knots, and apply coat of knot sealer before applying primer.
      2) Sand surfaces that will be exposed to view, and dust off.
      3) Prime edges, ends, faces, undersides, and backsides of wood.
      4) After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
3. Wood for Staining or Transparent Coatings:
   a. Interior Wood:
      1) Scrape and clean knots, and apply coat of knot sealer before applying primer.
      2) Apply wood filler paste to open-grain woods to produce smooth, glasslike finish.
         (a) Sand surfaces exposed to view and dust off.
         (b) After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.
4. Doors:
   a. Wood Doors to be field finished: Seal wood door top and bottom edge surfaces with clear sealer.
   b. Metal Doors to be field painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. General: Apply all coatings in accordance with manufacturer's instructions based on conditions present.
B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
C. Apply products in accordance with manufacturer's written instructions.
D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
F. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
H. Sand wood and metal surfaces lightly between coats to achieve required finish.
I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
J. Wood to Receive Transparent Coatings: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
L. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.4 FIELD QUALITY CONTROL

A. Owner will provide field inspection.

3.5 SCHEDULE

A. Locations as shown on Drawings.
B. (P-1) Interior Paint
    1. Field paint and door frames.
    2. Manufacturer: Sherwin-Williams.
    3. Color: SW 9581 Cotton.
    4. Finish: Satin or Semi-Gloss.
C. (P-2) Interior Paint
    1. Accent paint (light).
    2. Manufacturer: Sherwin-Williams.
    3. Color: SW 6247 Krypton
    4. Finish: Satin or Semi-Gloss.
D. (P-3) Interior Paint
    1. Accent paint (dark).
    2. Manufacturer: Sherwin-Williams.
    3. Color: SW 6250 Granite Peak.
    4. Finish: Satin or Semi-Gloss.
E. (P-4) Interior Paint
    1. Matches existing base in corridor.
    2. Manufacturer: Sherwin-Williams.
    3. Color: SW 9162 African Gray.
    4. Finish: Semi-Gloss.

END OF SECTION

SECTION 101400 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Delegated design of signage and supports.
B. Dimensional character signs.
C. Illuminated dimensional characters.
D. Panel Signs.
E. Applied Decal Signs.

1.2 RELATED REQUIREMENTS

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section in accordance with Section 013100 - Project Management and Coordination.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.4 SUBMITTALS

A. Qualification Data: For 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: Provide product criteria, characteristics, accessories, jointing and attachment methods.
D. Shop Drawings:
   1. Show sign mounting heights, locations of supplementary supports, and accessories.
   2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
   3. Wiring Diagrams: Power, signal, and control wiring.
E. Sample: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
   1. Dimensional Characters: Full-size Samples of each type of dimensional character (letter, number, and graphic element).
   2. Aluminum: For each form, finish, and color, on 6 inch long sections of extrusions and squares of sheet at least 4 by 4 inches.
   3. Acrylic Sheet: 8 by 10 inches for each color required.
   4. Polycarbonate Sheet: 8 by 10 inches for each color required.
   5. Panel Signs: Not less than 12 inches square for each type.
   6. Accessories: One of each, for each type.
F. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
G. Maintenance Data: For user's 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 manufacturers' brochures and parts lists describing the actual materials installed.
H. Closeout Submittals:

1.5 MAINTENANCE MATERIAL

A. Spare parts, extra stock, tools.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualification: Company specializing in the manufacture of work specified in this section with minimum 5 years of 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. Fabricators Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.
D. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.

1.7 MOCKUP

A. Visual and Constructability Mockup:
   1. Construct and participate as specified in Section 014339 - Mockups.
B. Fabricate sign mockup, representing finished work including material, color, finishes, and attachment method.
C. Locate where directed.
D. Mockup may remain as part of the Work.

1.8 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.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Signage as required by code and to facilitate wayfinding.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Tactile and Braille Characters: Text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Produce precisely formed characters with square-cut edges free from burrs and cut marks. Text shall be accompanied by Grade 2 Braille. Braille dots with domed or rounded shape produced using Raster Method.
   1. Raised-Copy Thickness: Not less than 0.7 mm and not more than 3 mm.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2.3 MATERIALS

A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.
C. Steel Sheet: Uncoated, cold-rolled, ASTM A1008/A1008M, commercial steel, Type B, exposed.
D. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
E. Steel Members Fabricated from Plate or Bar Stock: ASTM A529/A529M or ASTM A572/A572M, 42,000-psi (290-MPa) minimum yield strength.
F. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
G. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:
   1. Impact Resistance: 16 ft-lb/in. per ASTM D256, Method A.
   2. Tensile Strength: 9000 lbf/sq. in. per ASTM D638.

3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D790.
4. Heat Deflection: 265 degrees F at 264 lbf/sq. in. per ASTM D648.
5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.

H. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing, suitable for exterior applications.
1. Opaque Vinyl: Basis of Design: 3M Scotchcal Electro Cut Graphic Film, or a comparable product by the following:
   a. Gerber Scientific Products.
2. Translucent Vinyl: Basis of Design: 3M Scotchcal Electro Cut Graphic Film, Dusted Crystal Translucent Vinyl, or a comparable product by the following:
   a. Gerber Scientific Products.
3. Printed Vinyl Sheet: Digitally printed vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing. Apply UV and water resistant coating to face of sheet. Apply sheet to panels indicated.

2.4 FINISHES

A. Aluminum Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.
B. Stainless Steel: No. 4 finish.
C. Painted Finishes: Specification is based on products listed by Matthews Paint.
1. Comparable products by one of the following are also acceptable. See Section 016000 - Product Requirements for submittal requirements.
   a. Akzo Nobel.
2. Substitutions for products by manufacturers other than those listed above: See Section 016000 - Product Requirements.
3. Steel and Galvanized Steel:
   a. Primer: 274 Series Epoxy Primer, color as required for topcoat color indicated, 1.5 - 2.0 mils DFT.
   b. Topcoat: MAP Low VOC Satin Acrylic Polyurethane, 2.0 mils DFT minimum, satin sheen unless indicated otherwise.
4. Aluminum:
   a. Primer: 274 Series Epoxy Primer, color as required for topcoat color indicated, 1.5 - 2.0 mils DFT.
   b. Topcoat: MAP Low VOC Satin Acrylic Polyurethane, 2.0 mils DFT minimum, satin sheen unless indicated otherwise.
5. Acrylic, Polycarbonate:
   a. Primer: 74777SP/01 Tie Bond 0.4 - 0.6 mils DFT.
   b. Topcoat: MAP Low VOC Satin Acrylic Polyurethane, 2.0 mils DFT minimum, satin sheet unless indicated otherwise.
6. Clear Coat:
   a. 281228SP/01, VOC Satin Clear, 2.0 mils DFT minimum, satin sheen unless indicated otherwise.

2.5 FABRICATION

A. Dimensional character signs:
1. Fabricated Channel Characters: Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories.

2. Provide manufacturer's hardware for projection mounting of channel characters at distance from wall surface indicated.
3. Signage material, color and finish as Scheduled.

B. Panel Signs:
1. Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner signs.
2. Edge Condition: Square.
3. Corner Condition: Square.
4. Mounting: Unframed, as indicated.
a. Wall or Projection mounted with concealed attachment.
b. Manufacturer's standard anchors for substrates encountered.
5. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.

C. Applied Decal Signs:
1. Applied Vinyl Characters: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing. Apply copy to surfaces indicated.

2.6 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. Manufacturer's optional accessories required by the project:
1. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
2. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory paint brackets in color matching background color of panel sign.
3. Cable: Fabricate cable and fittings for cable mounted signs from stainless steel cable to suit panel sign construction and mounting conditions indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.4 ADJUSTING

A. Adjust and lubricate hardware for proper operation.

3.5 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.6 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

3.7 SCHEDULE

A. Building Identification Sign: Dimensional character sign; Stainless Steel, Thickness: As required for size of letters indicated; Finish: #4 Satin, Size and mounting as indicated.

B. Building Address Sign: Polycarbonate, dimensional letters.
C. Room and Door Identification Signs: In compliance with Local Code.
D. Emergency Evacuation Signs: Panel Signs with printed map slot, surface mounted, locations as indicated and in compliance with local code.
E. Parking Signs: Aluminum Panel Signs.
F. Directional Bicycle Parking Sign: Applied Vinyl on Glass.
G. Interpretive Sign: Acrylic Panel Sign.
H. Alarmed Exit Sign: Applied vinyl lettering.

END OF SECTION

SECTION 102600 - WALL AND CORNER PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. **Corner guards.**
- B. Plastic sheet wall protection.

1.2 RELATED REQUIREMENTS

1.3 SUBMITTALS
- A. Product Data: Provide product criteria, characteristics, accessories, jointing and methods, and termination details for curtains, track and accessories.
- B. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
- C. Maintenance Data: For user's operation and maintenance of system including:
  1. Methods for maintaining system's hardware, operation, materials and finishes.
  2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.
  3. Recommendations on maintenance schedule.

1.4 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum of 5 years of experience.

1.5 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.

1.6 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

2.1 DESCRIPTION
- A. Surface applied wall protection including corner guards.

2.2 PERFORMANCE AND DESIGN CRITERIA
- A. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.3 MATERIALS
- A. (CG-1) Corner Guards:
  1. Surface mounted, high impact vinyl with extruded aluminum full height retainer and integral impact absorbing device.
  2. Surface Mounted, extruded one-piece unit without splices, installed with adhesive.
     - a. Manufacturer: **Stainless Steel Corner Guards by InPro.**
     - b. Material:
       1) Stainless Steel; Type 430; 16-gauge.
       2) Wing: 2-inches.
       3) Height: 4-feet.
       4) Finish: Satin, No. 4.
       5) Post Formed Plastic.
  3. Stainless steel guards, flush-mounted, 4 ft. high.
- B. **(WC-2)** Rigid Sheet Wall Protection.

1. Rigid Sheet Wall Protection:
    a. Manufacturer: **Palladium Rigid Sheet by InPro**.
        1) Substitutions for products by manufacturers other than those listed above: See Section 01 60 00-Product Requirements.
    b. Features:
        1) Thickness: .040-inch.
        2) Corner: Aluminum Inside - 409A.
        3) Vertical Divider: Aluminum - 408A.
        4) Corner Guard: Aluminum - 420A.
        5) Color: Wood Drift 0116.

2.4 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.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work, including location of blocking.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

B. Install components plumb, level, square, and in proper alignment with drawings.

3.4 ADJUSTING

A. Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by Architect.

3.5 CLEANING

A. Dispose of all waste material in accordance with project's Waste Management Plan.

3.6 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 108013 - MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall organizer.
B. Digital clock.
C. TV Display.

1.2 SUBMITTALS

A. Product Data: Manufacturer's printed product literature for each type of specialty, indicating colors, locations, overall dimensions.
B. Samples: Submit sample of finish options for verification.
C. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.3 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.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Miscellaneous items to include wall organizer, digital clock and tv display.

2.2 WALL ORGANIZER

A. (LD-1) Literature Display.
B. Manufacturer: Takeform.
C. Features:
    1. Product: PH4A01-P2.
    2. Dimensions: 53-inches wide x 14-inches high x 3.2-inches deep.
    3. Weight: 15 lbs.
    4. Profile: End stops.
    5. Mounting: Screw mount.
    6. Face Material: DA0m001 Frosted Clear Acrylic.
    7. Backer Material: LW8214 Phantom Charcoal.
    8. Hardware: 05 Polished.

2.3 DIGITAL CLOCK

A. Manufacturer: **Electric Time**. www.electrictime.com, Thomas Erb, (508)-359-9684
B. Features:
    1. Product: **1100 Silhouette Tower Clock**.
    2. Raised dial markings: Aluminum.
    3. Hands: "HH" design.
    4. Dial Markings: "FF" design.
    5. Diameter: Per drawings.
    6. Spacers: 1/4-inch Lg.
    7. Markers: 3/16-inch thick.
    8. Ring: Aluminum trim ring.
    9. Style: Style WP-11XX Design.
    10. Finishes: Dial markings, trim ring and hands to have a black polyurethane finish. Background to have an off-white painted finish. Other standard colors available which are: medium or dark bronze (matches Duranodic #312 & #313), off-white, bright white, matte-black, satin aluminum, forest green, red or gold.
    11. Movement: Style MI Design. 24VAC drive motor and electronics. 8 second maximum run time. Alternating hall effect switched closed loop minute impulse operation. Composite

lubrication free bearings. Single source: Clock and movement to be manufactured by the same company.

12. Controller required for operation: Provide Type 99B-MI automatic reset control.
    a. IP65 Enclosure – Indoor & Outdoor Use.
    b. Automatically resets clock after power failures.
    c. Automatically resets clocks for daylight savings time (if required).
    d. Precision Quartz Time base 4 minutes per year maximum drift.
    e. Optional GPS – no drift.
    f. Built in 100 year daylight savings time calendar.
    g. 2 Line 16 character backlighted LCD display.
    h. ETL listed to UL 863.
    i. Power Failure Event logging.
    j. Standard MI output – 4 clocks maximum standard
    k. Standard 24VDC RP output -20 clocks maximum
    l. Sweep Second hand output
    m. Hour Strike Capability.
    n. RS-232 and RS-485 output ports
    o. 24 VAC hour strike output – configurable pulse output

2.4 COMMERCIAL DISPLAY

A. (TV-1) Television Display:
    1. Manufacturer: **Samsung**.

B. Features:
    1. Product: **QBR Series UHD Commercial Display**.
    2. Size: 43-inches; QB43R.
    3. Type: Edge LED BLU.
    4. Resolution: UHD (3840 x 2160).
    5. Brightness: 350.
    6. Sound: Speaker type.
    7. Power Supply: AC 100 - 240 V ~ (+/- 10%).
    8. Mounting: Wall mount WMN4070SE.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install neatly, with horizontal edges level.
C. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

SECTION 110114 - FALL ARREST & FALL RESTRAINT SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Anchors.

1.2 RELATED REQUIREMENTS

A. 079005 - Joint Sealers: Sealants installed with fall arrest and fall restraint system.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Owner Coordination Meeting: Convene prior to starting design and layout work of this section.

1.4 SUBMITTALS

A. Qualification Data: For manufacturer, installer, and design engineer.

B. Product Data: Provide product criteria, characteristics, accessories, performance data, and limitations.

C. Shop Drawings: Indicate required flashings and sealing at membrane penetrations.

1. Show rooftop locations of fall arrest anchors provisions of this Section and all applicable Federal, State and Local Regulations.
2. Show interface with adjacent materials.

D. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

E. Maintenance Data: For user's 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.

F. Closeout Submittals:

1. Project Record Drawings: Show location of each fall arrest anchor as installed.
2. Submit two copies of reduced plastic laminated as-built drawing showing anchor locations and details for posting near roof access points.
3. Maintenance and Operating Data: Include manufacturer's maintenance procedures, safety inspection log book for yearly inspections, manufacturer's videotape illustrating usage of fall arrest and fall restraint systems, and on-site personal instructions to Owner's personnel in use of equipment.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.

1. Carrying specific liability insurance (products and completed operations) in the amount of $2,000,000.00 to protect against product/system failure.

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 approved by manufacturer, specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.

1.6 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.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. System of components designed to allow free movement of persons over entire roof while attached by full body harness in accordance with requirements of ASME A120.1 and OSHA 1910.66 app C for structural connections and components.

2.2 PERFORMANCE AND DESIGN CRITERIA
- A. Design and layout system to conform to State Industrial Safety Regulations.
- B. Design and layout system to conform to additional requirements of OSHA - Occupational and Safety Health Administration Standards.
  1. OSHA - Occupational and Safety Health Administration Standards.
     a. OSHA Standards for the Construction Industry 29 CFR.
        1) 1910.66 Appendix C.
        2) 1926.500 Subpart M through § 1926 Subpart M Appendix E.
- C. Design fall arrest anchor system to allow free movement of persons over entire roof while attached by full body harness, retractable life line or vertical life line to horizontal life lines attached to Connection point (D-ring or eye or other) at each fall arrest anchor. Include quick release attachments.
- D. Design upright anchors as instructed by manufacture in layout acceptable to Owner's representative. Space uprights so that the fewest number of horizontal life lines is required.
- E. Design to safety factor to meet ASME A120.1 and OSHA 1910.66 app C for structural connections and components.
  1. Design fall arrest system for one person and fall restraint system for up to four persons on roof.
  2. Design fall arrest anchors with permanent attachments to roof structure to resist the load required and pullout force and as required by current code.
  3. Design fall arrest system to limit fall distance to 6 foot and to limit arrest force to that required or less per the current code.

2.3 MATERIALS
- A. Anchors:
  1. Basis of Design: Miller Single D Permanent Roof Anchor by Honeywell-Miller.
  2. Performance Criteria:
     a. Connection points: Provide for a 310 pound minimum Proof Load and as required for loading of the system.
  3. Features:
     a. Steel Pipe: Galvanized or stainless steel.
     b. Selection of roof and wall anchors available from single manufacturer.

2.4 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.

PART 3 EXECUTION

3.1 EXAMINATION
- A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION
- A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION
- A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.4 FIELD QUALITY CONTROL
- A. Field test anchors:
  1. Test 25 percent of all anchors.
  2. Test using load cell test apparatus in accordance with manufacturer's recommendations.

3.5 ADJUSTING
- A. Adjust and lubricate moving parts for proper operation.

3.6 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 123600 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Delegated design of wall hung counter supports.
B. Countertops for cabinetwork.

1.2 RELATED REQUIREMENTS

A. 064100 - Architectural Wood Casework: For casework supporting countertops.
B. 102800 - Toilet Accessories: For counter mounted accessories.

1.3 ADMINISTRATIVE REQUIREMENTS

1.4 SUBMITTALS

A. Qualification Data: For design engineer and fabricator.
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: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.
D. Shop Drawings: Complete details of materials and installation.
E. Sample: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
    1. For sealant and accessories submit manufacturer's full range of available colors and patterns for selection.
F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
G. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
I. Maintenance Data: For user's 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. Recommendations on maintenance schedule.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Professional structural engineer with 5 years of documented experience in design of this work and licensed in the location of the project.
B. Fabricators Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience on projects of similar size and complexity.
C. Installer Qualifications: Company specializing in performing the work of this section with minimum of 5 years of experience.

1.6 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.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Wall hung and casework supported countertops fabricated from plastic laminate and quartz/resin.

2.2 MATERIALS

A. (QTZ-1) Natural Quartz Countertops:
    1. Manufacturer: **Caesarstone**.

a. Substitutions for products by manufacturers other than those listed: See Section 016000 - Product Requirements.

2. Performance Criteria:
   a. Natural Quartz: Complying with ISFA-2 and NEMA LD 3; orthopthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
   c. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
   d. NSF approved for food contact.
   e. Sinks: Integral castings; minimum 3/4 inch wall thickness; comply with ANSI Z124.3.
3. Features:
   a. Product: 5104120200010.
   b. Collection: Classico.
   c. Color: 4120 Raven.
   d. Finish: Polished.
   e. Pattern: Speckled.
   f. Size: 56.5-inches x 120-inches.
   g. Exposed Edge Treatment: Miter edge profile.

2.3 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. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
   1. Made with binder containing no urea formaldehyde.
C. Grommet:
   1. Manufacturer: **Mockett**.
   2. Color: Matte Black (90).
   3. Maximum Cord Thickness: 13/16-inch diameter.
   4. Table Thickness: 7/8-inch minimum.
D. Counter Bracket:
   1. Manufacturer: Rakks.
   2. Product: Inside Wall Mount EH Counter Support Bracket.
   3. Size: EH-1209FM (counters up to 13-inches depth).
   4. Finish: Clear anodized.
E. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
F. Joint Sealant: Mildew-resistant silicone sealant, as selected by Architect from manufacturer's full range.

2.4 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and secure finish surfaces with contact surfaces with a waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION
   A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION
   A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
   B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
   C. Seal joint between back/end splashes and vertical surfaces.
      1. Where indicated use rubber cove molding.
      2. Where applied cove molding is not indicated use specified sealant.
   D. Joints between adjacent pieces of surfacing.
      1. Securely join with manufacturer's approved adhesive.
      2. Fill joints level with surfacing.
      3. Clamp or brace surfacing in position until adhesive sets.
      4. Joints shall be flush, tight fitting, level, and neat.

3.4 TOLERANCES
   A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
   B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
   C. Field Joints: 1/8 inch wide, maximum.

3.5 CLEANING
   A. Clean countertops surfaces thoroughly.
   B. Dispose of all waste material in accordance with project's Waste Management Plan.
      1. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.6 PROTECTION
   A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

END OF SECTION

SECTION 230500 – HVAC GENERAL CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. The work described in the project drawings and specifications are provided to show the owner and designer's intent on the mechanical systems. It is the responsibility of the contractor to provide complete installation services to fulfill the design's intent and to comply with all codes, standards, laws, and ordinances.

B. The mechanical work described in this division includes, but is not limited to the following systems:
   1. Piping
   2. Heating
   3. Ventilation
   4. Exhaust Venting
   5. Air conditioning and heating systems.
   6. Controls and instrumentation
   7. Included are any incidental items not shown, but necessary for a complete system.

1.2 ACTION SUBMITTALS

A. Submit project data in accordance with Division 1. Individual sections within Division 23 indicate items to be submitted. Investigate the capacity and space requirements of the proposed equipment before submitting.

B. Prepare and submit Coordination Drawings. Architect will review for aesthetic purposes in areas of exposed structure and reserves the right to make minor adjustments in layout for aesthetic reasons.

1.3 COORDINATION

A. Contractor is to be thoroughly acquainted with the work involved and is to verify at site all measurements necessary for the proper installation of the work.

B. Refer to architectural, structural, and electrical drawings for building construction and other details which affect the mechanical installation, and confer with all trades to properly coordinate work. Arrange to have visible portions of work (such as access doors, grilles, sprinkler heads, escutcheons, refrigerant piping connections, etc.) fit in and harmonize with the finish in a manner satisfactory to the Architect. In case of location conflict between trades, notify the Architect. His/her decision is final. No increase in the contract amount will be allowed due to changes due to location conflicts.

C. Provide coordinated HVAC shop drawings, no smaller than 1/4" scale showing all trades within two months of award of contract (including but not limited to HVAC, Plumbing, Fire Protection, Lighting, and Communications).

D. Use sufficient skilled workers of the journeyman level, and competent supervisors to insure a proper installation throughout the job.

E. Comply with all applicable Federal and local codes and regulations. Codes and regulations shall take precedence over any materials or methods specified.

F. Codes and Standards:
   1. 2018 International Building Code with Washington State Amendments
   2. 2018 International Mechanical Code with Washington State Amendments
   3. 2018 Uniform Plumbing Code with Washington Amendments
   4. 2018 Washington State Energy Code
   5. ASME Boiler and Pressure Vessel Code
   6. ASHRAE 62.2-2014, 55-2014

G. Abbreviations contained in various sections of the specifications refer to the following organizations, societies and associations:
   1. AMCA Air Moving and Conditioning Association
   2. ANSI American National Standards Institute
   3. ARI Air Conditioning and Refrigeration Institute
   4. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
   5. ASME American Society of Mechanical Engineers
   6. ASTM American Society for Testing and Materials
   7. AWS American Welding Society

8. CS Commercial Standards
9. EEI Edison Electrical Institute
10. FM Factory Mutual
11. IGSHPA International Ground Source Heat Pump Association
12. NBFU National Bureau of Fire Underwriters
13. NEC National Electrical Code
14. NEMA National Electrical Manufacturers' Association
15. NFPA National Fire Protection Association
16. OSHA Occupational Safety and Health Administration
17. SAE Society of Automotive Engineers
18. SMACNA Sheet Metal and Air Conditioning Contractors' National Association
19. UL Underwriter's Laboratories, Inc.

H. Fees and Permits: Permit and permit fees by contractor.
I. All pressure vessels, safety devices and appurtenances shall bear an ASME stamp.
J. All electrical devices and wiring shall comply with the standards of NEC. All devices shall be UL listed and so identified.

1.4 DRAWINGS

A. The mechanical drawings are diagrammatic and do not show all offsets required. Make field measurements and prepare shop drawings to ensure all components fit into the space provided.
B. The arrangement of equipment and piping has been based on items of equipment of a specific manufacture which are typical of the several makes that may be listed. If the equipment selected by the Contractor varies from the details on the drawings, contractor shall be responsible to coordinate any changes.
C. Coordinate the work with other trades and specification divisions. Ductwork has precedence over piping.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Completely cover motors and other moving machinery to protect from dirt and water during construction.
B. Cap all openings in ductwork to protect against entry of foreign material. HVAC equipment is not to be operated until all dust-creating construction activities in the building are completed.
C. Protect premises and work of other divisions from damage arising out of installation of work in this division.
D. Perform work in manner precluding unnecessary fire hazard.
E. Protect material, equipment, and apparatus under this division from damage, water, dust, and freezing, both in storage and installed, until final acceptance. Provide temporary storage facilities for materials and equipment.

1.6 WARRANTIES

A. Comply with Division 1 and the following
B. Provide a minimum of one year warranty on parts and labor. This warranty shall be in addition to any manufacturer's warranty that may be for less than one year.

1.7 PROJECT CLOSEOUT

A. Use cleaning materials recommended by the manufacturer of surface to be cleaned and follow directions on container.
B. Vacuum clean diffusers, grilles, registers, louvers, and screens after all construction is complete. Sweep up all debris from mechanical rooms and remove from the site.
C. Clean all mechanical equipment to remove dust, grease, and fingerprints.
D. Provide maintenance manuals, guarantees, inspection certificates, and record drawings in accordance with Division 1.
E. Upon completion of the project, after cleaning is complete and before project is air balanced, provide clean air filters throughout.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials required for Division 23 are specified in the individual sections.

B. All materials must be new and of the latest model of manufacture.
C. Source: Where several items of the same type are required, such as air handlers and fans, all shall be of the same manufacture.

PART 3 - EXECUTION

3.1 GENERAL
A. Obtain approval from the Building Official and all required permits before proceeding with work in this division.
B. Install all equipment in accordance with manufacturers' recommendations unless specifically directed otherwise.

3.2 PRODUCT HANDLING
A. Protect material, equipment, and apparatus provided under this division from damage, water, dust, and freezing, both in storage and installed, until final acceptance. Provide temporary storage facilities for material and equipment.

3.3 SLEEVES AND INSERTS
A. Locate and install sleeves, inserts and supports during the stages of construction. Make minor changes in the ductwork, piping, and other equipment locations due to structural obstructions or conflicts with work specified in other divisions.

3.4 ROOF PENETRATIONS
A. Coordinate roof penetration locations with General Contractor.

3.5 CUTTING, DRILLING AND PATCHING
A. Provide openings required in the existing construction for mechanical work. Use skilled mechanics of the proper trade. Core drilling and/or saw cutting shall be used. Use of jackhammer is specifically prohibited.

3.6 OPERATION AND MAINTENANCE MANUAL
A. Comply with Division 1 and the following:
B. Furnish an operation and maintenance manual for each item of equipment. Furnish four copies of the manual, bound in hardback binders, or an approved equivalent. Furnish one complete manual prior to the time that equipment tests are performed, and furnish the remaining manuals before the contract is completed.
C. Cover is to have inscribed the following identification: the words OPERATION AND MAINTENANCE MANUAL, the name and location of the equipment or the building, the name of the Contractor, and the contract number. The manual shall include name, address and telephone number of each subcontractor installing equipment, and of the local representatives for each item of equipment.
D. The manual shall have a table of contents and be assembled to conform to the table of contents with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
E. The manual shall include:
1. Wiring and control diagrams with data to explain detailed operation and control of each item of equipment.
2. A control sequence describing start-up, operation, and shutdown.
3. Description of the function of each principal item of equipment.
4. Procedure for starting.
5. Procedure for operating.
6. Shutdown operations.
7. Installation instructions.
8. Maintenance instructions.
9. Lubrication schedule including type, grade, temperature range, and frequency.
10. Safety precautions, diagrams, and illustrations.
11. Test procedures.
12. Performance data.
13. Parts list which indicates sources of supply, recommended spare parts, and service organization which is reasonably convenient to the project site.

F. The manual shall be complete in all respects for equipment, controls, accessories, and associated appurtenances provided.

END OF SECTION

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

1.1 SLEEVE-SEAL SYSTEMS

A. Field-assembled, modular sealing-element unit for filling annular space between piping and sleeve.
   1. Sealing Elements: EPDM rubber.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating.

1.2 SLEEVE-SEAL FITTINGS

A. Manufactured plastic, sleeve-type, plastic or rubber waterstop assembly made for imbedding in concrete slab or wall.

1.3 GROUT

A. Nonshrink, factory packaged.

1.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Exterior Concrete Walls above Grade:
   1. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
B. Exterior Concrete Walls below Grade:
   1. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
C. Concrete Slabs-on-Grade:
   1. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
D. Concrete Slabs above Grade:
   1. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
E. Interior Partitions:
   1. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Fiberglass pipe hangers.
   4. Metal framing systems.
   5. Fiberglass strut systems.
   6. Thermal-hanger shield inserts.
   7. Fastener systems.
   8. Pipe stands.
   9. Equipment supports.

B. Related Sections:
   1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
   2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
   3. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
   4. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
   1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, and system contents.
   2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
   3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a licensed Washington State professional structural engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
   1. Trapeze pipe hangers.
   2. Metal framing systems.
   3. Fiberglass strut systems.
   4. Pipe stands.
   5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of trapeze hangers.
   2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
B. Stainless-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
C. Copper Pipe Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Refrigerant Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
D. For Clevis or Band Hangers: Insert and shield shall cover entire circumference of pipe.
E. Insert Length: Extend 2 inches beyond sheet metal shield for piping.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
    1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    2. Obtain fusion without undercut or overlap.
    3. Remove welding flux immediately.
    4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
    1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
F. Use stainless-steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.
G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
H. Use padded hangers for piping that is subject to scratching.
I. Use thermal-hanger shield inserts for insulated piping and tubing.
J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
    2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

a. Light (MSS Type 31): 750 lb.
b. Medium (MSS Type 32): 1500 lb.
c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

1.1 PERFORMANCE REQUIREMENTS

A. Vibration and Siemic controls shall be provided as a deferred submittal and shall be designed and stamped by a licensed Washington State Structural Engineer.

B. Wind-Restraint Loading:
   1. Basic Wind Speed: 120mph.
   2. Building Classification Category: IV.
   3. Minimum 48.8 kg/sq. m multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

C. Seismic-Restraint Loading:
   1. Site Class as Defined in the IBC: B.
   2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.
      a. Component Importance Factor: 1.5.
      b. Component Response Modification Factor: 2.5.
      c. Component Amplification Factor: 2.5.

1.2 COMPONENTS

A. Vibration Isolators:
   1. Elastomeric Isolation Pads: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area. Material to be oil and water resistant with elastomeric properties.
      a. Surface Pattern: Waffle pattern.
      b. Infused nonwoven cotton or synthetic fibers.
      c. Load-bearing metal plates adhered to pads.
   2. Double-Deflection, Elastomeric Isolation Mounts: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
   3. Restrained Elastomeric Isolation Mounts: All-directional isolator with seismic restraints; molded, oil-resistant elastomeric material with cast-ductile-iron or welded-steel housing.
   4. Open-Spring Isolators: Freestanding, laterally stable.
   5. Housed-Spring Isolators: Freestanding, laterally stable, open-spring isolators in two-part telescoping housing.
   6. Restrained-Spring Isolators: Freestanding, laterally stable, open-spring isolators with vertical-limit stop restraint.
   7. Housed-Restrained-Spring Isolators: Freestanding, steel, open-spring isolators with vertical-limit stop restraint in two-part telescoping housing.
   8. Pipe-Riser Resilient Support: All-directional, acoustical pipe anchor.
   9. Resilient pipe guides.
   10. Air-Spring Isolators: Freestanding, single or multiple, compressed-air bellows.
   11. Restrained-Air-Spring Isolators: Freestanding, single or multiple, compressed-air bellows with vertical-limit stop restraint.
   12. Elastomeric hangers.
   13. Spring Hangers: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression and with vertical-limit stop.

B. Seismic Restraint Devices:
   1. Snubbers: Welded structural-steel shapes and replaceable resilient isolation washers and bushings.
   2. Restraint Channel Bracings: MFMA-4, shop- or field-fabricated bracing assemblies.
   3. Restraint Cables: ASTM A 603 galvanized-steel cables.
   4. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
   5. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
   6. Anchor Bolts: Mechanical type, seismic rated.

C. Vibration Isolation Equipment Bases:
   1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

1.3 FIELD QUALITY CONTROL

A. Testing: By Contractor.

END OF SECTION

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

1.1 QUALITY ASSURANCE

A. Quality Standard for Piping Identification: ASME A13.1.

1.2 PRODUCTS

A. Equipment Labels: Metal.
B. Warning Signs and Labels: 1/8 inch thick with fasteners.
C. Pipe Labels: Pretensioned.
D. Duct Labels: 1/8 inch thick with fasteners.
E. Valve Tags: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness.
F. Warning Tags: 3 by 5-1/4 inches minimum; brass grommet and wire fasteners.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:
   1. Certified TAB reports.
   2. Documentation of work performed per ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   3. Documentation of work performed per ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

B. TAB Firm Qualifications: AABC NEBB or TABB certified.

C. TAB Report Forms: Standard TAB contractor's forms approved by Architect.

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 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine the approved submittals for HVAC systems and equipment.

C. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

E. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

F. Examine strainers and verify that they have been cleaned prior to system operation.

G. Examine fan coil units and verify that they are accessible, and their controls are connected and functioning.

H. Examine automatic temperature system components to verify the following:
   1. Airside:
      a. Duct systems are complete with terminals installed.
      b. Volume, smoke, and fire dampers are open and functional.
      c. Clean filters are installed.
      d. Fans are operating, free of vibration, and rotating in correct direction.
      e. Variable-frequency controllers' startup is complete and safeties are verified.
      f. Automatic temperature-control systems are operational.
      g. Ceilings are installed.
      h. Windows and doors are installed.
      i. Suitable access to balancing devices and equipment is provided.
   2. Refrigerant:
      a. Verify leakage and pressure tests on refrigerant distribution systems have been satisfactorily completed.
      b. Shutoff valves have been verified to be 100 percent open.
      c. Suitable access to shut off devices and equipment is provided.
   3. Dampers, valves, and other controlled devices are operated by the intended controller.
   4. Dampers and valves are in the position indicated by the controller.
   5. Integrity of dampers and valves for free and full operation and for tightness of fully closed and fully open positions.
   6. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   7. Sensors are located to sense only the intended conditions.
   8. Sequence of operation for control modes is according to the Contract Documents.
   9. Controller set points are set at indicated values.
   10. Interlocked systems are operating.
   11. Changeover from heating to cooling mode occurs according to indicated values.

I. Report deficiencies discovered before and during performance of test and balance procedures.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.
C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare schematic diagrams of systems' "as-built" duct layouts.
B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
C. Verify that motor starters are equipped with properly sized thermal protection.
D. Check for airflow blockages.
E. Check condensate drains for proper connections and functioning.
F. Check for proper sealing of air-handling unit components.
G. Check for proper sealing of air duct system.
H. Comply with WSEC section C408.2.2.1 for fans with variable speed or ECM drives.

3.4 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:
    1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
    2. Verify that the system is under static pressure control.
    3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
    4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
        a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
        b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
        c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
        d. Adjust controls so that terminal is calling for minimum airflow.
        e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
    5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
        a. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
        b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
        c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
        d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

6. Measure fan static pressures as follows:
    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
    a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
    b. Verify that terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
9. Verify final system conditions as follows:
    a. Re-measure and confirm that minimum outdoor, exhaust airflows are within design. Readjust to match design if necessary.
    b. Re-measure and confirm that total airflow is within design.
    c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
    d. Mark final settings.
    e. Verify tracking between supply and return fans.

3.5 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.
B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
C. Report deficiencies observed.

3.6 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
    1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
    2. Include a list of instruments used for procedures, along with proof of calibration.
    3. Certify validity and accuracy of field data.
B. Final Report Contents: In addition to certified field-report data, include the following:
    1. Fan curves.
    2. Manufacturers' test data.
    3. Field test reports prepared by system and equipment installers.
    4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
C. General Report Data: In addition to form titles and entries, include the following data:
    1. Title page.
    2. Name and address of the TAB specialist.
    3. Project name.
    4. Project location.
    5. Architect's name and address.
    6. Engineer's name and address.
    7. Contractor's name and address.
    8. Report date.
    9. Signature of TAB supervisor who certifies the report.
    10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
    11. Summary of contents including the following:
        a. Indicated versus final performance.
        b. Notable characteristics of systems.
        c. Description of system operation sequence if it varies from the Contract Documents.
    12. Nomenclature sheets for each item of equipment.

13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Fan drive settings including settings and percentage of maximum pitch diameter.
    d. Settings for supply-air, static-pressure controller.
    e. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.
2. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Outdoor airflow in cfm.
    g. Exhaust airflow in cfm.

F. Apparatus-Coil Test Reports:
1. Coil Data:
    a. System identification.
    b. Location.
    c. Coil type.
2. Test Data (Indicated and Actual Values):
    a. Airflow rate in cfm.
    b. Average face velocity in fpm.
    c. Air pressure drop in inches wg.
    d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
    e. Return-air, wet- and dry-bulb temperatures in deg F.

f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.

G. Fan Test Reports: For supply, and exhaust fans, include the following:
1. Fan Data:
a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

I. Air-Terminal-Device Reports:
1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..
2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.

J. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.7 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of commissioning authority.
B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
E. If TAB work fails, proceed as follows:
1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.
F. Prepare test and inspection reports.

3.8 TOLERANCES

A. Set HVAC system airflow flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.9 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 230713 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC services:
   1. Indoor, supply, return, exhaust and outdoor air.
   2. Indoor, return located in unconditioned space.
   3. Indoor, exhaust between isolation damper and penetration of building exterior.
   4. Refrigerant suction and hot-gas piping, indoors and outdoors.
   5. Domestic Hot Water Piping, indoors and outdoors.

B. Related Sections:
   1. Section 233100 "HVAC Ducts and Casings" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail insulation application at elbows, fittings, dampers, valves, specialties and flanges for each type of insulation.
   3. Detail application of field-applied jackets.
   4. Detail application at linkages of control devices.
   5. Detail removable insulation at equipment connections.
   6. Detail field application for each equipment type.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Block Insulation: ASTM C 552, Type I.
   2. Special-Shaped Insulation: ASTM C 552, Type III.
   3. Board Insulation: ASTM C 552, Type IV.
   4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket.

I. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
J. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB.
K. For operating temperatures higher than 250 deg F (121 deg C), use high-temperature board insulation in first paragraph below.
L. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
M. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less.
N. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
O. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.

2.2 FIRE-RATED INSULATION SYSTEMS
A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

2.3 ADHESIVES
A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
D. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS
A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.
C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.5 SEALANTS
A. Joint Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
B. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
   4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
   5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Adhesive: As recommended by jacket material manufacturer.
   2. Color: White.
D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   1. Sheet and roll stock ready for shop or field sizing.
   2. Finish and thickness are indicated in field-applied jacket schedules.
   3. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
   4. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with **white** aluminum-foil facing.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches
   2. Thickness: 11.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 6.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.

6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Width: 2 inches.
   2. Thickness: 6 mils.
   3. Adhesion: 64 ounces force/inch in width.
   4. Elongation: 500 percent.
   5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Width: 2 inches
   2. Thickness: 3.7 mils.
   3. Adhesion: 100 ounces force/inch in width.
   4. Elongation: 5 percent.
   5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

B. Insulation Pins and Hangers:
   1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
      a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
      b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
      c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
   2. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
      a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
      b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
      c. Adhesive-backed base with a peel-off protective cover.
   3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
      a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

2.12 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Keep insulation materials dry during application and finishing.
G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
H. Install insulation with least number of joints practical.
I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
    1. Install insulation continuously through hangers and around anchor attachments.
    2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
    3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
K. Install insulation with factory-applied jackets as follows:
    1. Draw jacket tight and smooth.
    2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
    3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
        a. For below ambient services, apply vapor-barrier mastic over staples.
    4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
    5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
O. For above-ambient services, do not install insulation to the following:
    1. Vibration-control devices.
    2. Testing agency labels and stamps.
    3. Nameplates and data plates.
    4. Manholes.

5. Handholes.
6. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.
B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.
C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
   1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
E. Insulation Installation at Floor Penetrations:
   1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
B. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
C. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
D. Where PVDC jackets are indicated, install as follows:
   1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
   2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
   3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
   4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-

inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
B. Insulate duct access panels and doors to achieve same fire rating as duct.
C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.8 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.
B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
C. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Tests and Inspections:
   1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.
C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
   1. Indoor, supply and outdoor air.
   2. Indoor, return located in unconditioned space.
   3. Indoor, exhaust between isolation damper and penetration of building exterior.
   4. Indoor, Energy Recovery Ventilator Exhaust
   5. Outdoor, concealed supply and return.
   6. Outdoor, exposed supply and return.
B. Items Not Insulated:
   1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
   2. Factory-insulated flexible ducts.
   3. Factory-insulated plenums and casings.
   4. Flexible connectors.
   5. Vibration-control devices.
   6. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, with an R-value complying with the latest locally adopted energy code or to levels specified on building plans, minimum R-7.
B. Return-Air Duct and Plenum located in an unconditioned space, Insulation: Mineral-fiber blanket or board, with an R-value complying with the latest locally adopted energy code, minimum R-7.
C. Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, with an R-value complying with the latest locally adopted energy code, minimum R-11.
D. Exhaust-Air Duct and Plenum:

1. Between isolation damper and penetration of building exterior, Insulation: Mineral-fiber blanket or board, with an R-value complying with the latest locally adopted energy code, minimum R-19.
2. Between Energy Recovery Ventilator and building exterior, Insulation: Mineral-fiber blanket or board, with an R-value complying with the latest locally adopted energy code, minimum R-11.

3.12 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
   1. Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, with an R-value complying with the latest locally adopted energy code, minimum R-11.
   2. Return-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, with an R-value complying with the latest locally adopted energy code, minimum R-11.
   3. Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, with an R-value complying with the latest locally adopted energy code, minimum R-11.
   4. Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, with an R-value complying with the latest locally adopted energy code, minimum R-11.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. Ducts and Plenums:
   1. Aluminum, Smooth

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. Ducts, Plenums, and piping:
   1. Aluminum, Smooth

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.
B. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, 1 inch thick.
C. Domestic hot water piping: Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inches thick.

3.16 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:
   1. Flexible Elastomeric: 1 inches thick.
B. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall bethe following:
   1. Flexible Elastomeric: 1 inches thick.

3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. Piping, Concealed:
   1. PVC: 20 mils thick.
C. Piping, Exposed:
   1. PVC: 20 mils thick.

3.18 Outdoor, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. Piping, Concealed:
   1. PVC: 20 mils thick.
C. Piping, Exposed:
   1. Aluminum: smooth.

END OF SECTION

SECTION 230800 – COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of the Commissioning process for this project including responsibilities for Division 23

B. The commissioning process in this section shall be used to comply with 2018 Washington State Energy Code, C408, System Commissioning as well as C103.6, Building Documentation and Close out Submittal Requirements.

C. The certified commissioning professional (CCP) directs and coordinates all commissioning activities; this section describes some but not all of the commissioning professional's responsibilities.

1. The commissioning professional is hired by the Owner or the Architect. The commissioning professional reports directly to the Owner.
2. The CCP shall meet energy code certification requirements.

D. The commissioning process, including acceptance of equipment and systems within the Scope of Commissioning, is to be completed before Final Inspection.

1.2 SCOPE OF COMMISSIONING

A. Building cooling and heating

1. Variable refrigerant flow (VRF) heat pump systems
2. Electric space heaters
3. Single zone heat pump
4. Controls for cooling and heating

B. Building Ventilation

1. Energy recovery ventilators
2. Duct terminals
3. Restroom exhaust fans (existing, not to be modified)
4. Controls for ventilation equipment
5. Building Air Balance

C. The following scope is EXCLUDED from the commissioning process

1. Envelope upgrades and air leakage testing. Scope of work is excluded per exception to 2018 WSEC section C503.3 since the project does not include change of space conditions.
2. Service water heating system. Scope of work is excluded per exception 2 of 2018 WSEC section C408.1 since the total building system is less than 200 kBtu/h

1.3 RELATED REQUIREMENTS

A. 230553 - Identification for HVAC Piping and Equipment
B. 230593 - Testing, Adjusting, and Balancing for HVAC
C. 230923 – Direct Digital Control (DDC) system for HVAC
D. 230993 - Sequence of Operations for HVAC Controls
E. 233400 - HVAC Fans
F. 233600 – Air Terminal Units
G. 237200 - Packaged Air-to-Air Heat Recovery Equipment
H. 238143 - Inverter Driven Split System Heat Pumps

1.4 DEFINITIONS

A. CCP: Certified Commissioning Professional. An individual who is certified by an ANSI/ISO/IEC 17024:2012 accredited organization to lead, plan, coordinate, and manage commissioning teams and implement the commissioning process.

B. TAB: Test, Adjust, and Balance

1.5 ADMINISTRATIVE REQUIREMENTS

A. Commissioning Scope Meeting: Convene a meeting that includes the equipment installers for every system in section 1.2 and the project's CCP.
   1. Review the commissioning plan outlined in this section, including the functional test acceptance criteria in paragraphs 3.7.E.
   2. Review coordination and scheduling required for successful commissioning.
   3. Review and discuss TAB plan, including strategies and step-by-step procedures to accomplish a full system air balance in Section 230593 and paragraphs 3.4, 3.7.E and 3.7.G.

B. The CCP has reporting and review duties not listed in this section. 2018 Washington State Energy Code section c408 provides minimum CCP duties.

1.6 SUBMITTALS

A. Make submittals directly to the CCP on a time schedule specified by the CCP.

B. Follow standard submittal procedures to make corrections, as needed, until the submittal is approved by the CCP.

C. Submit an electronic copy to the CCP, for review and approval.

D. Submit the Following:
   1. Product submittals for equipment listed in Related Sections, above. For each product, provide the following:
      a. Manufacturers' Instructions: Submit copies of manufacturer-provided instructions that are shipped with equipment as soon as the equipment is delivered
      b. Copies of factory test reports shipped with the unit, if any
      c. Blank Startup Sheet
      d. Completed Startup Reports
   2. Start up reports per paragraphs 3.3, 3.4, and 3.5.
   3. Test and Balance
      a. Draft Test and Balance Report for use with Functional Testing
      b. Certified Test and Balance Report
   4. Operations and Maintenance data

1.7 RESPONSIBILITIES

A. Include and itemize the cost of commissioning in the contract price.

B. Follow the commissioning plan to organize and document the following activities:
   1. Install components, devices, equipment, and systems in accordance with the Contract Documents and the manufacturer's recommendations and instructions.
   2. Perform operational checkout of installed work.
   3. Execute functional test procedures in accordance with the Contract Documents and witnessed by the commissioning professional.
   4. Educate the owner and their operations personnel on proper system function.

C. Provide a draft TAB report within one week of TAB completion. Submit directly to the CCP. Provide the Commissioning professional with any requested data, gathered, but not shown on the draft reports.

D. Provide skilled technicians to perform functional testing under the direction of the Commissioning Professional. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

E. Correct deficiencies (differences between specified and observed performance) as interpreted by the Commissioning professional, owner, and engineer and retest the equipment.
F. Coordinate with the Commissioning Professional so they may witness training of the Owner's operating staff.
G. Commissioning Professional to meet with Owner's operating staff to go review and confirm that operating staff are trained on the design intent for the following:
    1. Energy recovery ventilators, including demand controlled ventilation
    2. Air Terminal Units (aka VAV boxes), including demand controlled ventilation
    3. VRF central controls
H. Warranty Period
    1. Execute seasonal or deferred functional testing, witnessed by the Commissioning professional, if required.
    2. Work with the commissioning provider to review the condition of outstanding issues related to the original and seasonal commissioning.
    3. Assist in correcting areas of concern that are still under warranty.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all test equipment necessary to fulfill the testing requirements of this Division.

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN

A. This specification section shall be considered the draft commissioning plan. After discussion during the Commissioning Scope Meeting, the CCP may modify the commissioning plan to match the discussion, and/or meeting outcomes.
B. Attend meetings called by the commissioning professional for purposes of completing the commissioning process as described in this section.
C. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

3.2 STARTUP

A. Complete systems and subsystems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning professional or Owner.
B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the Commissioning Professional and General Contractor. Beginning system testing before full completion does not relieve the Contractor from fully completing the system, including all prefunctional checklists, as soon as possible.
C. Field quality control activities are complete, as specified by other sections.

3.3 START-UP REPORTS FOR MECHANICAL

A. Manufacturer's start-up forms.
B. Installer's typical start-up form
C. Prefunctional checklists that confirm calibration of each carbon dioxide and pressure sensor
D. Building management system point to point checkout
E. VRF start-up reports are submitted, including written confirmation that the manufacturer's required warranty test has been completed successfully. Submit a copy of each manufacturer warranty document, if requested by the CCP.

3.4 ACCEPTANCE CRITERIA FOR TEST AND BALANCE

A. The draft TAB report is submitted early for use during functional testing.

3.5 FUNCTIONAL TESTING

A. A Functional Test is required for each item of equipment, system, or other assembly listed in paragraph 1.2. List of functional test procedures to be developed and executed by the CCP
   1. Building cooling and heating
   2. Building ventilation system
   3. Small HVAC equipment: electric heaters, single zone heat pumps, and exhaust fans
   4. Building Management system
B. Execute Functional Tests, after completion of Startup Reports and before Final Acceptance.
C. The commissioning professional is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.
D. Correct deficiencies and re-test at no extra cost to the Owner. If a deficiency is not corrected and re-tested immediately, the commissioning professional will document the deficiency and the Contractor's stated intentions regarding correction.
   1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
   2. When the deficiency has been corrected, notify the commissioning professional in writing. The commissioning professional will reschedule the test and the Contractor shall re-test, as necessary.
   3. Identical or Near-Identical Items: If 10 percent, or three units, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective. In this case, Contractor shall provide a proposal for correction within 2 weeks after notification of defect, including provisions for testing sample installations prior to replacement of all items.
   4. The Contractor shall bear the cost of Owner and commissioning professional personnel time for witnessing re-testing if the test failed due to failure to execute the relevant start-up correctly. If the test failed for reasons that would not have been identified in the start-up process, the Contractor shall bear the cost of the second and subsequent re-tests.

3.6 FUNCTIONAL TEST PREREQUISITES

A. The following applicable generic prerequisite checklist items are listed on each written functional test form and shall be completed and checked off by Commissioning professional prior to functional testing:
   1. All related equipment has been started up and start-up reports submitted and approved ready for functional testing
   2. All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with sensor calibrations completed.
   3. Current A/E punchlist items for this equipment corrected.
   4. These functional test procedures reviewed and approved by installing contractor.
   5. Test requirements and sequences of operation attached.
   6. Schedules and setpoints attached.
   7. False loading equipment, system, and procedures ready
   8. Sufficient clearance around equipment for servicing.
   9. Record of all values for pre-test setpoints changed to accommodate testing has been made and a check box provided to verify return to original values (control parameters, limits, delays, lockouts, schedules, etc.).

10. Other miscellaneous checks of the start-up reports completed successfully.

3.7 FUNCTIONAL TESTING REQUIREMENTS

A. Detailed functional testing requirements will be developed by the commissioning professional and submitted to the contractor for review.

B. Parties Responsible to execute Functional Test
   1. Mechanical Contractor: perform testing, correct deficiencies.
   2. CCP: assist with testing, document testing.
   3. Owners Representative: witness

C. Tested functions and/or modes
   1. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in contract documents
   2. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned including manual modes and power failure. Test functionality of this system in all control strategies or interlocks that it is associated with.

D. Required Monitoring
   1. None

E. Acceptance Criteria

Building ventilation system	
Equipment Type	Acceptance Criteria
Energy recovery ventilators	ERVs operate per the sequence of operations in Section 230993, including schedule (occupied, unoccupied), and maintenance of duct static pressure.
Energy recovery ventilators	Commissioning team to determine owner's desired schedule.
Energy recovery ventilators	Each ERV is controlled on a 7-day programmable control system set to match the owner's schedule.
Energy recovery ventilators	ERVs are confirmed to operate in a smooth fashion without undue noise in normal mode (occupied mode with duct terminals at normal, minimum position), in "demand ventilation" mode (1 or more duct terminals at maximum position), and in transition between low and high load.
VAV boxes	VAV boxes operate per the sequence of operations in Section 230993, including schedule (occupied, unoccupied), and occupied CO2 controls (minimum, ramp up, ramp down).
Test and Balance Verification	Each energy recovery ventilator's minimum pressure setting is measured and customized during test and balance. The minimum setting is the value that provides correct ventilation airflow when all duct terminals are in minimum position.
Test and Balance Verification	A random sample of up to 25 % the TAB report data shall be selected for verification (air velocity, air flow rate, pressure differential, etc.). The original TAB contractor will execute the checks, witnessed by the CCP. The TAB contractor will use the same test instruments as used in the original TAB work. Failure of an item is defined as follows: 1. For air flow of supply and return: a deviation of more than 10% of instrument reading 2. For minimum ventilation air flow: 20% of instrument reading 3. For air and water pressures: a deviation of more than 10% of full scale of test instrument reading

Building cooling and heating: variable refrigerant flow	
Equipment Type	Acceptance Criteria
VRF indoor heat pumps	Indoor heat pump controls are programmed to cycle indoor unit fans on thermostat call, sensing at the thermostats.
VRF indoor heat pumps	Indoor heat pump controls are programmed so that simultaneous heating and cooling cannot occur (e.g. there is only 1 system serving each space and/or interlocks are installed and functioning)
VRF system	Each VRF system operates per the sequence of operations in Section 230993, including temperatures (heating, cooling) and schedule (occupied, unoccupied).

Small HVAC equipment: electric heaters, single zone heat pumps, and exhaust fans	
Equipment Type	Acceptance Criteria
EF-1	EF-1 serving the police station operates 24-7 on low speed. When a person enters the holding cell, EF-1 ramps up to high speed. Occupancy sensor is set for 30-minute time delay.
EF-2 and EF-3	The restroom exhaust fans operate on occupancy sensor from EITHER restroom. Confirm that fan turns ON & OFF based on a person walking into either restroom with the other room vacant. Set for 30 minute time delay.
HPs in interior Elec and Elev Rooms	IHP-TELEC: Thermostat is set for cooling mode and labeled "Cooling Mode Only. Set for 75F". When feasible, heating mode is jumpered out.
Electric Heaters	EH-type electric heaters operate via remote thermostat.

Building Management System	
	Acceptance Criteria
BMS Interface	The building management system is connected to every ERV and VAV box.
BMS Communication	The building management system is communicating with the city-wide BMS, as required.
BMS Monitoring	The building management system is monitoring every ERV and VAV box, as required in the contract documents.
BMS Trend Logs	Permanent trend logs are established within the BMS, as determined during the commissioning process for other mechanical systems

F. Sampling Strategy
   1. Test 100% of energy recovery ventilators, fans, and electric heaters
   2. Test 15% of VRF indoor heat pumps

G. Post Occupancy Testing
   1. Test and balance work is performed for each energy recovery ventilator to confirm thermal effectiveness.
      a. Perform testing with outdoor air temperatures below 50F.
      b. Perform testing after the building is occupied during normal occupied hours.

c. Refer to the manufacturer's performance chart to determine the expected supply air and exhaust air temperatures based on the outdoor temperature during the test.
d. Adjust the supply and relief fan speeds to achieve a minimum of 75% thermal effectiveness.

2. Additional post-occupancy testing to be determined during Commissioning Scope Meeting

END OF SECTION

SECTION 230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

1.1 SYSTEM DESCRIPTION

A. System Description: Microprocessor-based monitoring and control including analog/digital conversion and program logic.
B. DDC System: Web based or Web compatible.
C. Delegated Design: Engage a qualified professional engineer to design DDC system.
D. DDC System Speed:
    1. Response Time of Connected I/O:
        a. AI Point Values: Two seconds.
        b. BI Point Values: Two seconds.
        c. AO Points: Two second(s).
        d. BO Point Values: Two second(s).
    2. Display of Connected I/O:
        a. Analog Point COV: Five Insert number seconds.
        b. Binary Point COV: Five seconds.
        c. Alarms of Analog and Digital Points: 30 seconds.
        d. Graphic Display Refresh: Four seconds.
        e. Point Change of Values and Alarms Displayed from Workstation to Workstation: Graphic refresh rate indicated.
E. Network Bandwidth: 30 percent available spare bandwidth.
F. DDC System Data Storage: Server(s): 24 consecutive months of historical data for all I/O points connected to system.
G. Future Expandability: Two times total I/O points.
H. Input Point Displayed Accuracy:
    1. Energy:
        a. Thermal: Within 1 percent of reading.
        b. Electric Power: Within 1 percent of reading.
    2. Flow:
        a. Air: Within 5 percent of design flow rate.
        b. Air (Terminal Units): Within 5 percent of design flow rate.
    3. Gas:
        a. Carbon Dioxide: Within 50 ppm.
    4. Moisture (Relative Humidity):
        a. Air: Within 5 percent RH.
    5. Pressure:
        a. Air, Ducts and Equipment: 1 percent of instrument range.
        b. Space: Within 1 percent of instrument range.
    6. Temperature, Dew Point:
        a. Air: Within 1 deg F.
        b. Space: Within 1 deg F.
        c. Outdoor: Within 1 deg F.
    7. Temperature, Dry Bulb:
        a. Air: Within 1 deg F.
        b. Space: Within 1 deg F.
        c. Outdoor: Within 1 deg F.
        d. Temperature Difference: Within 0.25 deg F.
        e. Other Temperatures Not Indicated: Within 1 deg F.
    8. Temperature, Wet Bulb:
        a. Air: Within 1 deg F.
        b. Space: Within 1 deg F.
        c. Outdoor: Within 1 deg F.
I. Precision of I/O Reported Values:
    1. Current:
        a. Milliamperes: Nearest 1/100th of a milliampere.

b. Amperes: Nearest 1/10th of an ampere up to 100 A; nearest ampere for 100 A and more.

2. Energy:
   a. Electric Power:
      1) Rate (Watts): Nearest 1/10th of a watt through 1000 W.
      2) Rate (Kilowatts): Nearest 1/10th of a kilowatt through 1000 kW; nearest kilowatt above 1000 kW.
      3) Usage (Kilowatt-Hours): Nearest kilowatt through 10,000 kW; nearest 10 kW between 10,000 and 100,000 kW; nearest 100 kW for above 100,000 kW.
3. Flow:
   a. Air: Nearest 1/10th of a cfm through 100 cfm; nearest cfm between 100 and 1000 cfm; nearest 10 cfm between 1000 and 10,000 cfm; nearest 100 cfm above 10,000 cfm.
4. Gas:
   a. Carbon Dioxide (ppm): Nearest ppm.
   b. Carbon Monoxide (ppm): Nearest ppm.
   c. Oxygen (Percentage): Nearest 1/10th of 1 percent.
   d. Refrigerant (ppm): Nearest ppm.
5. Moisture (Relative Humidity):
   a. Relative Humidity (Percentage): Nearest 1 percent.
6. Level: Nearest 1/100th of an inch through 10 inches; nearest 1/10 of an inch between 10 and 100 inches; nearest inch above 100 inches.
7. Speed:
   a. Rotation (rpm): Nearest 1 rpm.
   b. Velocity: Nearest 1/10th fpm through 100 fpm; nearest fpm between 100 and 1000 fpm; nearest 10 fpm above 1000 fpm.
8. Position, Dampers and Valves (Percentage Open): Nearest 1 percent.
9. Pressure:
   a. Air, Ducts and Equipment: Nearest 1/10th in. w.c..
   b. Space: Nearest 1/100th in. w.c..
   c. Steam: Nearest 1/10th psig through 100 psig; nearest psig above 100 psig.
   d. Water: Nearest 1/10 psig through 100 psig; nearest psig above 100 psig.
10. Temperature:
    a. Air, Ducts and Equipment: Nearest 1/10th of a degree.
    b. Outdoor: Nearest degree.
    c. Space: Nearest 1/10th of a degree.
    d. Chilled Water: Nearest 1/10th of a degree.
    e. Condenser Water: Nearest 1/10th of a degree.
    f. Heating Hot Water: Nearest degree.
    g. Heat Recovery Runaround: Nearest 1/10th of a degree.
    h. Steam: Nearest degree.
11. Vibration: Nearest 1/10th in/s.
12. Voltage: Nearest 1/10 volt up to 100 V; nearest volt above 100 V.

J. Control Stability:
1. Flow:
   a. Air, Ducts and Equipment, except Terminal Units: Within 2 percent of design flow rate.
   b. Air, Terminal Units: Within 5 percent of design flow rate.
2. Gas:
   a. Carbon Dioxide: Within 5 ppm.
3. Moisture (Relative Humidity):
   a. Air: Within 2 percent RH.
   b. Space: Within 5 percent RH.
   c. Outdoor: Within 5 percent RH.
4. Pressure:

a. Air, Ducts and Equipment: 1 percent of instrument range.
b. Space: Within 1 percent of instrument range.

5. Temperature, Dew Point:
   a. Air: Within 1 deg F.
   b. Space: Within 1 deg F.
6. Temperature, Dry Bulb:
   a. Air: Within 2 deg F.
   b. Space: Within 2 deg F.
7. Temperature, Wet Bulb:
   a. Air: Within 1 deg F.
   b. Space: Within 1 deg F.

K. Environmental Conditions for Controllers, Gateways, and Routers:
1. Outdoors, Protected: Type 2.
2. Outdoors, Unprotected: Type 4.
3. Indoors, Heated with Filtered Ventilation: Type 1.
4. Indoors, Heated with Non-Filtered Ventilation: Type 2.
5. Indoors, Heated and Air Conditioned: Type 1.
6. Mechanical Equipment Rooms:
   a. Air-Moving Equipment Rooms: Type 1.
7. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
8. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4.

L. Environmental Conditions for Instruments and Actuators:
1. Outdoors, Protected: Type 2.
2. Outdoors, Unprotected: Type 4.
3. Indoors, Heated with Filtered Ventilation: Type 1.
4. Indoors, Heated with Non-Filtered Ventilation: Type 2.
5. Indoors, Heated and Air-conditioned: Type 1.
6. Mechanical Equipment Rooms:
   a. Air-Moving Equipment Rooms: Type 1.
7. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
8. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4.
9. Hazardous Locations: Explosion-proof rating for condition.

M. DDC System Reliability: DDC controllers, gateways, routers: 40,000 hours.

N. Electric Power Quality:
1. Power-Line Surges:
   a. Protect DDC system products connected to ac power circuits from power-line surges.
   b. No fuses for surge protection.
   c. Two waveforms:
      1) 10-by-1000-mic.sec. waveform with a peak voltage of 1500 V and a peak current of 60 A.
      2) 8-by-20-mic.sec. waveform with a peak voltage of 1000 V and a peak current of 500 A.
2. Power Conditioning: DDC system products.
3. Ground Fault: Protect products.

O. Backup power source.

P. DDC System Products Powered by UPS:
1. Desktop operator workstations.
2. Printers.
3. Servers.
4. Gateways.
5. DDC controllers.

Q. DDC System Instruments and Actuators Powered by UPS:
1. Basement level ventilation, heat pumps, and dhw systems.

R. Continuity of operation after electric power interruption for applications with systems and equipment connected to backup power systems.

1.2 SYSTEM COMPONENTS

A. Panel-Mounted, Manual Override Switches:
   1. Manual override of control dampers.
   2. Manual override of control valves.

1.3 SYSTEM ARCHITECTURE

A. System architecture shall consist of no more than two levels of LANs.
B. Minimum Data Transfer and Communication Speed:
   1. LAN Connecting Operator Workstations and Network Controllers: 100 Mbps.
   2. LAN Connecting Programmable Application Controllers: 1000 kbps.
   3. LAN Connecting Application-Specific Controllers: 115,000 bps.
C. Modular and able to expand to not less than two times system size.
D. Perform modifications without having to remove and replace existing network equipment.
E. Number of LANs and associated communication transparent to operator.
F. Independence of any single device for system alarm reporting and control execution.
G. Special Network Architecture Requirements:
   1. Air-Handling Systems and VAV Terminals: Dedicated LAN.

1.4 DDC SYSTEM OPERATOR INTERFACES

A. Operator Means of System Access:
   1. Desktop and portable operator workstation with hardwired connection.
   2. Portable operator terminal with hardwired connection through LAN port.
   3. Portable operator workstation with wireless connection through LAN router.
   4. PDA with wireless connection through LAN router.
   5. Remote connection using outside of system personal computer or PDA through Web access.
   6. Remote connection using portable operator workstation and telephone dial-up modem.
B. Operator transparent access to system, regardless of operator means used.
C. Hardwired Network Ports:
   1. Each mechanical equipment room.
   2. Fire-alarm system command center.
D. Desktop Workstations:
   1. Connect to Level one LAN through a communications port directly on LAN or through a communications port on a DDC controller.
   2. Able to communicate with any device located on any DDC system LAN.
   3. Able to communicate, with modems, remotely with any device connected to any DDC system LAN.
E. Portable Workstations:
   1. Connect to DDC system Level one LAN through a communications port directly on LAN or through a communications port on a DDC controller.
   2. Able to communicate with any device located on any DDC system LAN.
   3. Connect to DDC system Level two LAN through a communications port on an application-specific controller, or a room temperature sensor connected to an application-specific controller.
   4. Connect to system through a wireless router connected to Level one LAN.
   5. Able to communicate with any device connected to any system LAN regardless of point of physical connection to system.
   6. Monitor, program, schedule, adjust set points, and report capabilities of I/O connected anywhere in system.
   7. Have dynamic graphic displays that are identical to desktop workstations.
F. Telephone Communications:
   1. Through use of a standard modem to communicate with any device connected to any system LAN.
   2. Have auto-dial and auto-answer communications.
   3. Desktop and Portable Operator Workstation Computers with Modems:

a. Operators able to perform control functions, report functions, and database generation and modification functions.
b. Automatically answer calls, and either file or display information sent remotely.
c. Communications transparent to operator.

4. DDC Controllers: No modems.
5. DDC Controllers with Modems:
   a. Automatically place calls to report critical alarms, or to upload trend and historical information for archiving.
   b. Analyze and prioritize alarms to minimize initiation of calls.
   c. Buffer noncritical alarms in memory and report them as a group of alarms, or until an operator manually requests an upload.
   d. Make provisions for handling busy signals, no-answers, and incomplete data transfers.
   e. Call default devices when communications cannot be established with primary devices.

G. Critical Alarm Reporting:
   1. Operator-selected critical alarms sent by DDC system.
   2. Send alarm notification to multiple recipients.
   3. Notify recipients by any or all means, including e-mail, text message, and prerecorded phone message to mobile and landline phone numbers.
H. Simultaneous Operator Use: Five simultaneous operators.

1.5 NETWORKS

A. Acceptable Networks for Connecting Operator Workstations and Network Controllers:
   1. ATA 878.1, ARCNET.
   2. CEA-709.1-C.
   3. IP.
   4. IEEE 8802-3, Ethernet.
B. Acceptable Networks for Connecting Programmable Application Controllers:
   1. ATA 878.1, ARCNET.
   2. CEA-709.1-C.
   3. IP.
   4. IEEE 8802-3, Ethernet.
C. Acceptable Networks for Connecting Application-Specific Controllers:
   1. ATA 878.1, ARCNET.
   2. CEA-709.1-C.
   3. EIA-485A.
   4. IP.
   5. IEEE 8802-3, Ethernet.

1.6 NETWORK COMMUNICATION PROTCOL

A. Industry Standard Protocols:
   1. ASHRAE 135.

1.7 DESKTOP OPERATOR WORKSTATIONS

A. Personal computer.
B. Keyboard.
C. Pointing device.
D. Flat panel display monitor.
E. Speakers.
F. I/O cabling.

1.8 PORTABLE OPERATOR WORKSTATIONS

A. Network interface card.
B. Digital video disc rewrite recorder (DVD+/-RW).
C. Leather carrying case.
D. Docking station.
E. Wireless-N communication card.
F. Bluetooth module with 2.1 standard technologies.

G. Mobile broadband card.
H. Wireless optical mouse.
I. Light-sensitive Web cam and noise-cancelling digital array microphone.
J. Cable with network jackets on each end.

1.9 SYSTEM SOFTWARE

A. System Software Minimum Requirements:
   1. Real-time multitasking and multiuser 64-bit operating system.
   2. Capable of operating DOS and Microsoft Windows applications.
   3. Database management software.
   4. Network communications software manages and controls multiple network communications.
   5. Operator interface software includes day-to-day operator transaction processing, alarm and report handling, operator privilege level and data segregation control, custom programming, and online data modification capability.
   6. Scheduling software shall schedule centrally based time and event, temporary, and exception day programs.
B. Operator Interface Software:
   1. English language.
   2. Minimize use of a typewriter-style keyboard.
   3. Manual operator sign-off.
   4. Programmable automatic sign-off period.
   5. Recorded and printed operator sign-on and sign-off activity.
   6. Security access.
   7. Data segregation.
   8. Operators Commands:
      a. Start or stop selected equipment.
      b. Adjust set points.
      c. Add, modify, and delete time programming.
      d. Enable and disable process execution.
      e. Lock and unlock alarm reporting for each point.
      f. Enable and disable totalization for each point.
      g. Enable and disable trending for each point.
      h. Override control loop set points.
      i. Enter temporary override schedules.
      j. Define holiday schedules.
      k. Change time and date.
      l. Enter and modify analog alarm limits.
      m. Enter and modify analog warning limits.
      n. View limits.
      o. Enable and disable demand limiting.
      p. Enable and disable duty cycle.
      q. Display logic programming for each control sequence.
   9. Reporting:
      a. General listing of points.
      b. List points currently in alarm.
      c. List of off-line points.
      d. List points currently in override status.
      e. List of disabled points.
      f. List points currently locked out.
      g. List of items defined in a "Follow-Up" file.
      h. List weekly schedules.
      i. List holiday programming.
      j. List of limits and deadbands.
   10. Summaries: For specific points, for a logical point group, for an operator selected group(s), or for entire system without restriction due to hardware configuration.
C. Graphic interface software.

D. Project-specific graphics.
E. Customizing software.
F. Alarm handling software.
G. Reports and logs.
H. Standard Reports:
    1. All I/O: With current status and values.
    2. Alarm: All current alarms, except those in alarm lockout.
    3. Disabled I/O: All I/O points that are disabled.
    4. Alarm Lockout I/O: All I/O points in alarm lockout, whether manual or automatic.
    5. Alarm Lockout I/O in Alarm: All I/O in alarm lockout that are currently in alarm.
    6. Logs:
        a. Alarm history.
        b. System messages.
        c. System events.
        d. Trends.
I. Custom reports.
J. Tenant override reports.
K. HVAC equipment reports.
L. Project-specific utility reports.
M. Weather reports.
N. Standard trends.
O. Custom trends.
P. Database management software.

1.10 ASHRAE 135 (BACnet) GATEWAYS

A. Gateway Minimum Requirements:
    1. Read and view all readable object properties on non-BACnet network to BACnet network and vice versa where applicable.
    2. Write to all writeable object properties on non-BACnet network from BACnet network and vice versa where applicable.
    3. Include single-pass (only one protocol to BACnet without intermediary protocols) translation from non-BACnet protocol to BACnet and vice versa.
    4. Includes data sharing read property, data sharing write property, device management dynamic device binding, and device management communication control.
    5. Hardware, software, software licenses, and configuration tools for operator-to-gateway communications.
    6. Backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

1.11 ASHRAE 135 (BACnet) PROTOCOL ANALYZER

A. Analyzer minimum capabilities:
    1. Capture and store to a file data traffic on all network levels.
    2. Measure bandwidth usage.
    3. Filtering options with ability to ignore select traffic.

1.12 CEA-709.1-C (LON) NETWORK HARDWARE

A. Routers.
B. Gateways.

1.13 WIRELESS ROUTERS FOR OPERATOR INTERFACE

A. Single-band wireless routers.
B. Dual-band wireless routers.

1.14 DDC CONTROLLERS

A. DDC Controller Spare Processing Capacity:
    1. Network Controllers: 50 percent.
    2. Programmable Application Controllers: Not less than 60 percent.
    3. Application-Specific Controllers: Not less than 70 percent.
B. DDC Controller Spare I/O Point Capacity:
    1. Network Controllers: 10 percent of each AI, AO, BI, and BO point connected to controller.

2. Programmable Application Controllers: 10 percent of each AI, AO, BI, and BO point connected to controller.
3. Application-Specific Controllers: 10 percent of each AI, AO, BI, and BO point connected to controller.

C. Input and Output Point Interface:
1. Controller AIs perform analog-to-digital (A-to-D) conversion with a minimum resolution of 12 bits or better to comply with accuracy requirements indicated.
2. Controller AOs perform analog-to-digital (A-to-D) conversion with a minimum resolution of 12 bits or better to comply with accuracy requirements indicated.
3. BIs include a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against effects of contact bounce and noise.
4. Controller BOs include relay contact closures or triac outputs for momentary and maintained operation of output devices.

1.15 NETWORK CONTROLLERS

A. Communication: Communicate with other devices on DDC system Level one network.
B. Operator Interface: Equipped with a service communications port for connection to a portable operator's workstation or PDA.
C. Local keypad and display.

1.16 PROGRAMMABLE APPLICATION CONTROLLERS

A. Communication: Communicate with other devices on network.
B. Operator Interface: Equipped with a service communications port for connection to a portable operator's workstation or PDA.
C. Local keypad and display.

1.17 APPLICATION-SPECIFIC CONTROLLERS

A. Microprocessor-based controllers.
B. Operator interface with a service communications port for connection to a portable operator's workstation. Connection shall extend to port on space temperature sensor that is connected to controller.

1.18 CONTROLLER SOFTWARE

A. General Controller Software Requirements: I/O points shall be identified by up to 30-character point name and up to 16-character point descriptor. Same names shall be used at operator workstations.
B. Security: Individual security passwords and user names.
C. Scheduling:
1. Weekly Schedule: Include separate schedules for each day of week.
2. Exception Schedules: Operator able to designate any day of the year as an exception schedule.
3. Holiday Schedules: Operator able to define up to 99 special or holiday schedules.
D. System Coordination: Operator able to group equipment based on function and location.
E. Binary Alarms: Alarm based on operator-specified state.
F. Analog Alarms: Both high and low alarm limits and able to be automatically and manually disabled.
G. Alarm Reporting: Able to determine action to be taken in event of an alarm, routed to appropriate operator workstations based on time and other conditions, and able to start programs, print, be logged in event log, generate custom messages, and display graphics.
H. Remote Communication: Able to dial out in the event of an alarm.
I. Electric power demand limiting.
J. Maintenance Management: Monitor equipment status and generate maintenance messages based on operator-designated run-time, starts, and calendar date limits.
K. Sequencing: Application software to properly sequence chillers, boilers, and other applicable HVAC equipment.
L. Control Loops
1. Support Control Loops:
a. Two-position (on/off, open/close, slow/fast) control.
b. Proportional control.

c. Proportional plus integral (PI) control.
d. Proportional plus integral plus derivative (PID) control.
e. Adaptive (automatic tuning).

M. Staggered-start applications.
N. Energy calculations.
O. Anti-short cycling.
P. On and off control with differential.
Q. Run-time totalization.

1.19 RELAYS

A. General-purpose relays.
B. Multifunction time-delay relays.
C. Latching relays.
D. Current sensing relay.
E. Combination on-off status sensor and on-off relay.

1.20 ELECTRICAL POWER DEVICES

A. Transformers.
B. Power-line conditioner.
C. Transient voltage suppression and high-frequency noise filter unit.
D. DC power supply.

1.21 UNINTERRUPTABLE POWER SUPPLY (UPS) UNITS

A. 250 through 1000 VA.
B. 1000 through 3000 VA.

1.22 PIPING AND TUBING

A. Pneumatic, and Pressure Instrument Signal Air, Tubing and Piping:
1. Copper tubing.
2. Copper tubing connectors and fittings.
3. Galvanized-steel piping.
4. Polyethylene tubing.
5. Polyethylene tubing connectors and fittings.

B. Process Tubing:
1. Copper tubing.
2. Copper tubing connectors and fittings.
3. Stainless-steel tubing.
4. Stainless-steel tubing connectors and fittings.

1.23 CONTROL WIRE AND CABLE

A. Wire: Single conductor control wiring above 24 V.
B. Single Twisted Shielded Instrumentation Cable above 24 V.
C. Single Twisted Shielded Instrumentation Cable 24 V and Less.
D. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.

1.24 RACEWAYS FOR CONTROL WIRING, CABLING, AND TUBING

A. Metal Conduits, Tubing, and Fittings:
1. PVC-Coated Steel Conduit: Rigid steel conduit.

B. Nonmetallic Conduits, Tubing, and Fittings:
1. Coilable HDPE.

C. Surface Metal Raceways: Galvanized steel with snap-on covers.

1.25 FIBER-OPTIC CABLE, CONNECTORS, AND RACEWAY

A. Fiber: Multimode graded index.
B. Connection: Fiber-optic connectors.
C. Cable suitable for use with 100Base-FX or 100Base-SX standard (as applicable).
D. Connectors.
E. Splice organizer cabinet.
F. Raceways: Nonmetallic, flexible raceway system manufactured specifically for routing fiber-optic cables.
G. Cable Identification: Numeric designation, source, destination, and cable type.

1.26 ACCESSORIES
- A. Pneumatic pressure gages.
- B. Pressure electric switches.
- C. Damper blade limit switches.
- D. I/P and E/P transducers.
- E. E/P switches.
- F. Instrument enclosures.
- G. Manual valves.
  1. Needle type.
  2. Ball type.
- H. Wall-mounted portable operator's workstation cabinet.

1.27 IDENTIFICATION
- A. Instrument Air Pipe and Tubing: Engraved tags with the service and pressure range.
- B. Control Equipment, Instruments, and Control Devices: Engraved tags.
- C. Valve tags: Brass tags and brass chains attached to valve.
- D. Raceway and Boxes: Painted labels on cover plates.
- E. Equipment Warning Labels: Acrylic label with pressure-sensitive adhesive back and peel-off protective jacket.

1.28 SOURCE QUALITY CONTROL
- A. Testing Agency: Owner engaged.

1.29 FIELD QUALITY CONTROL
- A. Testing Agency: Owner engaged.

END OF SECTION

SECTION 230993.11 - SEQUENCE OF OPERATIONS FOR HVAC DDC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes control sequences for DDC for HVAC systems, subsystems, and equipment.

B. Contractor shall review design and attached sequence and notify design team of any errors, conflicts, inconsistencies, or other issues which will not allow for the successful achievement of the sequence of operations described here.

C. General contractor shall coordinate with HVAC, Controls, electrical, and plumbing sub to clearly establish roles and responsibilities associated with delivery of the work described in this section.

D. Related Requirements:

1. Instrumentation and Control Systems for HVAC for control equipment.
2. Commissioning of HVAC

1.2 SUBMITTALS

A. Controls contractor shall rewrite sequence of operations for their programmers and using their nomenclature. Submit copy of this sequence for review.

B. Upon completion, controls contractor shall submit a .csv file of the energy metering points for review.

C. Provide maintenance manual and operator training for all control systems used to implement the sequence described in this specification. Training shall last a minimum of 1 day and shall cover user-interface operation, trending, trouble-shooting, and current sequence setpoints.

1.3 SYSTEM DESCRIPTION

A. Ventilation shall be supplied to occupied spaces with dedicated outside air systems with packaged energy recovery ventilators. ERVs shall be controlled by the DDC system. Central ERVs shall supply ventilation air to VAV boxes, VAV boxes will be controlled by zone CO2 and occupancy sensors, while ERV fans shall be controlled by duct static pressure. Single zone VRF manufacturer ERVs shall be controlled by the proprietary VRF control system.

B. The building shall be heated and cooled with VRF heat pumps. VRF heat pumps shall be controlled by the VRF system's proprietary controls. The VRF control system shall be integrated with the DDC system to allow for remote monitoring from the central DDC system. Scheduling shall be performed with the web-based VRF systems application.

C. Additional systems requiring control include but are not limited to:

1. Exhaust fans.
2. Electric resistance heaters.
3. Domestic hot water circulation pumps.

1.4 INITIAL SETTINGS

A. Temperature Setpoints

1. Main building zones:
   a. Occupied hours - Heat 68°F, Cool 76°F. (± 2F deadband)
   b. Unoccupied hours - Heat 63°F, Cool 85°F.
   c. Electric Water Heater Tanks – 120 F (± 2F deadband).
2. Police Station
   a. Occupied hours - Heat 68°F, Cool 76°F. (± 2F deadband)

B. CO2 Setpoints

1. Maximum 900 ppm (adj).

C. Schedule (confirm with client before acceptance)

1. Floors 1 & 2:
   a. Monday-Friday: Occupied 7AM-6PM
   b. Saturday-Sunday: Unoccupied
   c. Federal Holidays: Unoccupied
2. Basement:
   a. Occupied 24-7

1.5 Multi Zone Packaged ERV Sequence of Operation

A. Unit shall come with factory controller to implement sequence described below. BACNET gateway shall allow for DDC system integration. The DDC system shall enable/disable unit and adjust CO2 setpoint and collect data points identified below.

B. Enable/disable unit on schedule.
    1. Pressure Reset:
        a. Reset supply-air pressure setpoint in response to vav box primary air damper position. Reset supply air pressure down by 0.1” every 5 minutes until a VAV box primary air damper reaches 85% open. If any primary air damper reaches 95% open, increase supply air pressure setpoint in increments of 0.1” every five minutes.
            1) Minimum exterior static pressure shall be 0.5” (adj)
            2) Maximum exterior static pressure shall be 1.25” (adj).
    2. Supply Fan Variable-Volume Control:
        a. Fan Speed Control: control fan to maintain duct static pressure setpoint.
        b. Set variable-frequency drive restart value to minimum speed when fan is stopped.
    3. Exhaust Fan Variable-Volume Control:
        a. Control exhaust fan to fixed offset with supply fan to maintain balanced flow in space match exhaust air-flow rate to supply air-flow rate.
        b. If supply fan is off, exhaust fan shall be off.
        c. Set variable-frequency drive restart value to minimum speed when fan is stopped.

C. Indicate the following on the operator's workstation display terminal:
    1. DDC system graphic.
    2. DDC system on-off indication (operating or not operating).
    3. Outdoor-air-temperature indication.
    4. Supply-fan on-off indication (operating or not operating).
    5. Supply-fan speed.
    6. Exhaust-fan on-off indication (operating or not operating).
    7. Exhaust-fan speed.
    8. Outside air temperature indication.
    9. Supply air temperature indication.
    10. Space temperature indication.
    11. Exhaust air temperature indication.
    12. Supply-air-pressure indication.
    13. Supply-air-pressure set point.

1.6 Single-Zone Packaged ERV Sequence of Operation

A. Unit shall come with factory controller to implement sequence described below. BACNET gateway shall allow for DDC system integration. The DDC system shall enable/disable unit and adjust CO2 setpoint and collect data points identified below.

B. Enable/disable unit on schedule and/or any occupancy sensor in zone served by unit.

C. Supply/Exhaust Fan Speed Control
    1. If CO2 levels are below setpoint (900 ppm, adj) fans will be at minimum speed.
    2. If CO2 levels are above setpoint, fans will ramp up to high speed until CO2 levels drop below 800 ppm (adj).

D. Indicate the following on the operator's workstation display terminal:
    1. DDC system graphic.
    2. DDC system on-off indication (operating or not operating).
    3. Outdoor-air-temperature indication.
    4. Supply-fan on-off indication (operating or not operating).
    5. Supply-fan speed.
    6. Exhaust-fan on-off indication (operating or not operating).
    7. Exhaust-fan speed.
    8. Outside air temperature indication.
    9. Supply air temperature indication.
    10. Space temperature indication.
    11. Exhaust air temperature indication.

1.7 Ventilation VAV Box Controls:

A. Variable-Air-Volume Terminal Air Units w/ CO2 Controls:
    1. Occupancy: Report occupancy and enable occupied CO2 set point.
        a. Occupied CO2 Setpoint: 900 ppm (adj).

2. If space is unoccupied, and CO2 concentration is below setpoint, damper shall be shut.
3. CO2 Concentration: Modulate damper to maintain space CO2 set points.
    a. If space is occupied, open damper to minimum flow rate, based on Ra value for space.
    b. If CO2 concentration exceeds setpoint, open linearly to maximum from minimum at 900 ppm (adj) to maximum at 1300 ppm (adj).
    c. If space temperature is below setpoint modulate damper actuator from full open to minimum position.
4. Indicate the following on the operator's workstation display terminal:
    a. Space/area served.
    b. Space occupied/unoccupied.
    c. Space CO2 indication.
    d. Space CO2 set point.
    e. Air-damper position as percentage open.

B. Variable-Air-Volume Terminal Air Units without CO2 controls:
1. Occupancy: Report occupancy.
2. If space is unoccupied, damper shall be shut.
3. If space is occupied, open damper to provide scheduled OA flow rate.
4. Indicate the following on the operator's workstation display terminal:
    a. Space/area served.
    b. Space occupied/unoccupied.
    c. Air-damper position as percentage open.

1.8 VRF Controls

A. Indoor Fan Coil Units
1. Indoor unit fans shall be off if space is at setpoint.
2. VRF controls will cycle indoor unit fans and refrigerant controls and outdoor units to maintain space temperature setpoints.
3. VRF t-stat occupancy sensors shall set-back indoor units when spaces are unoccupied.

B. Energy Recovery Ventilators
1. ERVs shall be off 1-hour before space is occupied and 1 hour after close of business and shall operate continuously during occupied hours.
2. ERVs shall operate at low-speed, unless called to high-speed by the space CO2 sensor.
3. ERV fans shall wait five minutes after mechanical dampers have been opened to turn on.

C. Outdoor Unit Controls
1. Outdoor units shall control compressor speed to match indoor unit loads.
2. Branch controllers shall respond to indoor unit load requirements and route refrigerant where necessary to meet loads.

D. Indicate the following on the operator's workstation display terminal <u>(read only)</u>:
1. DDC system graphic.
2. DDC system on-off indication (operating or not operating).
3. Mode
4. Status
5. Room Temp
6. Fan Speed
7. Alarm
8. Error Code
9. <u>Hyperlink to VRF manufacturers web-based control interface.</u>

1.9 Lighting Controls System Integration

A. The DDC system shall provide start/stop signals for as many lighting zones as required by the lighting designer. DDC system contractor to verify required number of points with lighting system installer. Lighting system installer shall sweep on/off lighting zones based on DDC system start/stop signals.

1.10 Energy Metering

A. DDC system shall meter and trend the following:
1. Heat Pumps

2. ERVs

B. DDC contractor to verify required number of meters with electrical contractor.
C. DDC contractor shall set up trends to output kWh use for each meter to a .csv file.
    1. kWh use .csv file shall be output automatically to CKSD server each month.
    2. kWh use .csv file shall include heading for each meter that identifies end-use
D. DDC contractor shall coordinate with electrical contractor to identify each meter's end-use and include that information in the .csv file.
E. Indicate the following on the operator's workstation display terminal for each meter:
    1. DDC system graphic.
    2. Instantaneous power draw (kW)
    3. Energy use (kWh)

1.11 VENTILATION SEQUENCES

A. Mechanical Dampers: Open outside air and exhaust air control dampers when associated exhaust fan or ERV is enabled. Shut when ERV or exhaust fan is not enabled.
    1. Include DDC monitoring of damper position.
B. Exhaust Fan with occupancy sensor: Cycle fan on when space is occupied.
C. Exhaust Fan with light switch: Cycle fan on when lights are turned on.
D. Exhaust Fan with timer: Cycle fan on when timer is enabled.
E. Exhaust Fan with Wall Switch: Cycle fan on with manual control.
F. Exhaust Fan with thermosat: Enable fan with line-voltage cooling thermostat set to 80 F.
    1. Monitor fan and damper status from DDC, include control system graphic.

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION (Not Applicable)
END OF SECTION

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.

B. Shop Drawings:
1. Show piping size and piping layout, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between indoor and outdoor unit, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:
1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L, ASTM B 280 type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

F. Flexible Connectors:
1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.

4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves at refrigerant control boxes to each indoor and outdoor unit.
B. Install flexible connectors at outdoor units.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
B. Install refrigerant piping according to ASHRAE 15.
C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
F. Install piping adjacent to machines to allow service and maintenance.
G. Install piping free of sags and bends.
H. Select system components with pressure rating equal to or greater than system operating pressure.
I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.
K. Install refrigerant piping in protective conduit where installed belowground.
L. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
M. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
N. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
   2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.
5. Pipe insulation shall be continuous through piping supports and hangers.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.

D. Support multifloor vertical runs at least at each floor.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
a. Fill system with nitrogen to the required test pressure.
b. System shall maintain test pressure at the manifold gage throughout duration of test.
c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.6 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 24 hours, system is ready for charging.
2. Break vacuum with refrigerant gas, allowing pressure to build up to pressure per manufacturer’s requirements.

END OF SECTION

SECTION 233113 - METAL DUCTS

1.1 QUALITY ASSURANCE
- A. Mockups for system static-pressure classifications higher than 3-inch wg.

1.2 MATERIALS
- A. Single-wall rectangular ducts and fittings.
- B. Double-wall rectangular ducts and fittings.
  1. Fibrous-glass duct liner for interstitial insulation.
  2. Perforated inner duct.
- C. Single-wall round and flat-oval ducts and fittings.
- D. Double-wall round and flat-oval ducts and fittings.
  1. Fibrous-glass duct liner for interstitial insulation.
  2. Perforated inner duct.
- E. Sheet Metal Materials:
  1. Galvanized sheet steel.
  2. PVC-coated, galvanized sheet steel.
  3. Carbon-steel sheets.
  4. Stainless-steel sheets.
  5. Aluminum sheets.
  6. Factory-applied antimicrobial coating.
- F. Duct Liner:
  1. Fibrous glass, Type I, flexible.
     a. With antimicrobial erosion-resistant coating.
  2. Flexible elastomeric.
  3. Natural fiber.
- G. Sealant Materials:
  1. Two-part tape sealing system.
  2. Water-based joint and seam sealant.
  3. Solvent-based joint and seam sealant.
  4. Flanged joint sealant.
  5. Flange gaskets.
  6. Round duct joint O-ring seals.

1.3 SEISMIC-RESTRAINT DEVICES
- A. Channel support system.
- B. Galvanized-steel restraint cables.
- C. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

1.4 DUCT CLEANING
- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Clean the following items:
  1. Air outlets and inlets.
  2. Return-air ducts, dampers, actuators, and turning vanes.
  3. Supply-air ducts, dampers, actuators, and turning vanes.
  4. Dedicated exhaust and ventilation components and makeup air systems.

1.5 DUCT SCHEDULE
- A. All ducts shall be galvanized steel except as follows:

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

1.1 QUALITY ASSURANCE

A. Installation Standards: NFPA 90A, NFPA 90B, and SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1.2 PRODUCTS

A. Backdraft and Pressure Relief Dampers: Multiple blade, parallel action, gravity balanced with return springs.
B. Barometric Relief Dampers: Horizontal or vertical mounting; multiple blade, parallel action, gravity balanced with return springs.
C. Manual Volume Dampers: Multiple and single blade, parallel- and opposed-blade design, with linkage outside airstream.
    1. Standard, steel, manual volume dampers.
    2. Standard, aluminum, manual volume dampers.
    3. Low-leak, steel, manual volume dampers.
    4. Low-leak, aluminum, manual volume dampers.
D. Control Dampers: Opposed-blade design; galvanized-steel frame and blades.
E. Fire Dampers: Static, electric heat-responsive device.
F. Ceiling Radiation Dampers: Replaceable heat-responsive device.
G. Smoke Dampers:
    1. Multiple-blade type.
    2. Leakage: Class I.
H. Combination Fire and Smoke Dampers: Dynamic, replaceable electric heat-responsive device.
I. Flange connectors.
J. Duct Silencers: Factory fabricated and tested, round or rectangular.
K. Turning Vanes: Single-blade, galvanized sheet steel.
L. Remote damper operators.
M. Duct-Mounted Access Doors: Double wall, rectangular, galvanized sheet steel with insulation.
N. Flexible Connectors: Indoor, high temperature.
O. Flexible Ducts: Insulated.
P. Duct security bars.
Q. Duct accessory hardware.

END OF SECTION

SECTION 233416 - CENTRIFUGAL HVAC FANS

1.1 AIRFOIL CENTRIFUGAL FANS
- A. Housings: Reinforced steel.
- B. Wheels: Steel.
- C. Shafts: Statically and dynamically balanced; steel with keyway.
- D. Bearings: Prelubricated and sealed type, with rating life of 120,000 hours.
- E. Belt Drives: Factory mounted and field adjustable.
  1. Service Factor: 1.5.
  2. Fan Pulleys: Cast iron or cast steel; split, tapered.
  3. Motor Pulleys: Adjustable pitch for motors through 5 hp; fixed pitch for larger motors.

1.2 BACKWARD-INCLINED CENTRIFUGAL FANS
- A. Housings: Reinforced steel.
- B. Wheels: Steel welded or riveted to flange and backplate.
- C. Shafts: Statically and dynamically balanced; steel with keyway.
- D. Bearings: Prelubricated and sealed type, with rating life of 120,000 hours.
- E. Belt Drives: Factory mounted and field adjustable.
  1. Service Factor: 1.5.
  2. Fan Pulleys: Cast iron or cast steel; split, tapered.
  3. Motor Pulleys: Adjustable pitch for motors through 5 hp; fixed pitch for larger motors.

1.3 FORWARD-CURVED CENTRIFUGAL FANS
- A. Housings: Reinforced steel.
- B. Wheels: Black enameled or galvanized steel.
- C. Shafts: Statically and dynamically balanced; steel with keyway.
- D. Bearings: Prelubricated and sealed type, with rating life of 120,000 hours.
- E. Belt Drives: Factory mounted and field adjustable.
  1. Service Factor: 1.5.
  2. Fan Pulleys: Cast iron or cast steel; split, tapered.
  3. Motor Pulleys: Adjustable pitch for motors through [**5**] <**Insert number**> hp; fixed pitch for larger motors.

1.4 PLENUM FANS
- A. Wheels: Airfoil; steel.
- B. Shafts: Statically and dynamically balanced; steel with keyway.
- C. Bearings: Prelubricated and sealed type, with rating life of 120,000 hours.
- D. Belt Drives: Factory mounted and field adjustable.
  1. Service Factor: 1.5.
  2. Fan Pulleys: Cast iron or cast steel; split, tapered.
  3. Motor Pulleys: Adjustable pitch for motors through 5 hp; fixed pitch for larger motors.

1.5 PLUG FANS
- A. Wheels: Airfoil; steel.
- B. Shafts: Statically and dynamically balanced; steel with keyway.
- C. Bearings: Prelubricated and sealed type, with rating life of 120,000 hours.
- D. Belt Drives: Factory mounted and field adjustable.
  1. Service Factor: 1.5.
  2. Fan Pulleys: Cast iron or cast steel split, tapered.
  3. Motor Pulleys: Adjustable pitch for motors through 5 hp; fixed pitch for larger motors.

END OF SECTION

SECTION 233600 - AIR TERMINAL UNITS

1.1 PRODUCTS

A. Shutoff, Single-Duct Air Terminal Units:
   1. Configuration: Volume-damper assembly inside unit casing.
   2. Casing: Galvanized steel, single wall.
      a. Lining: 3/4-inch- thick, fibrous-glass duct liner.
   3. Regulator Assembly: System-air-powered bellows.
   4. Volume Damper: Normally open, galvanized steel with maximum damper leakage of 2 percent at 3-inch wg inlet static pressure.
   5. Attenuator Section: Steel, sheet.
      a. Lining: 1-inch- thick, fibrous-glass duct liner.
   6. Factory-mounted and -wired, electric DDC microprocessor-based controls.
   7. Flow/delta pressure sensor.

B. Hangers and supports.

C. Seismic restraints.

1.2 SOURCE QUALITY CONTROL

A. Factory test assembled air terminal units.

1.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner engaged.

END OF SECTION

SECTION 233713 - AIR DIFFUSERS

1.1 PRODUCTS

A. Round ceiling diffusers, fully adjustable.
B. Rectangular and square ceiling diffusers, fixed and adjustable.
C. Perforated diffusers, panel mounted with pattern controllers.
D. Louver face diffusers.

END OF SECTION

SECTION 237200 – PACKAGED AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packaged air to air recovery units, also known as Dedicated Outside Air Units (DOAS) and Energy Recovery Ventilators (ERVs), see schedule on M0.02.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Air-to-air energy recovery equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.

1. Product Data: Submit product data for specified products with the following information
2. General layout drawing with plan and elevation views including are relevant dimensions
3. Performance schedule including airflow, heating and cooling capacities, electrical data, unit weight.
4. Full fan curve.
5. Sound power data by octave band for all openings and radiated through cabinet.
6. Electrical schematics including field wiring connections.
7. Component details including construction method and materials.
8. Control point schematic and complete written sequence of operation.
9. Curb mounting details.
10. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
11. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For air-to-air energy recovery equipment, accessories, and components, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ARI Compliance:

1. Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."

C. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."

D. UL Compliance:

1. Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators" and UL 1995, "Heating and Cooling Equipment."

E. Sound Levels Shall comply with Table 2:

Table 2: Maximum Permissible Sound Power Levels (PWL), dB, re 10^{-12} Watts

Mech Equip	Octave Band Sound Power at Center Frequency, Hz								
	Nom CFM	63	125	250	500	1000	2000	4000	8000
ERV-CL Fresh Air Blower	3000-4000	47	54	68	74	78	75	71	65
ERV-POD Fresh Air Blower	900-	85	91	87	80	74	67	63	62
ERV-SL Fresh Air Blower	1400-	82	84	80	73	69	61	59	57
ERV—601 Gym Discharge Radiated	13200 -	86 79	81 71	83 64	85 68	82 53	81 52	79 52	79 52
Fan Powered TU[1] Discharge Radiated	400-600		70 60	66 59	61 51	57 45	53 43	50 42	
Single Duct TU Discharge Radiated	350-500		67 52	64 45	62 40	60 40	49 40	44 37	

1. The sound levels present the maximum discharge and radiated noise at 1.0" w.g. (249 Pa) inlet pressure and 0.25" w.g. (63 Pa) discharge static pressure (full cooling, fan on and 100% primary air)

1.7 DELIVERY, STORAGE AND HANDLING

A. Store equipment away from construction areas where it may be damaged and protected from harmful weather conditions.
B. Keep factory shipping packaging in place until unit is ready to be installed.
C. Follow manufacturer's instructions for rigging and placement of equipment.

1.8 COORDINATION

A. Coordinate all system connections and building penetrations including electrical, gas and duct connections.
B. Coordinate curb placement, structural and roofing.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Total Heat Exchangers: 10 years.

PART 2 - PRODUCTS

2.1 DOAS unit w/ ERV

A. Manufacturers shall be:
   1. Swegon
   2. Ventacity
   3. Or approved equal
B. DOAS units shall be factory assembled and tested. Units shall include insulated steel cabinet with steel base, total recovery enthalpy core, fans and motors assembly, filter rack, and integral controls. Unit shall have single point power connections. Unit shall include controls required to meet Sequence of Operations.

2.2 CABINET

A. Insulation shall have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50. Cabinet exterior shall be 20 gauge prepainted steel that meets or exceeds 650 hour salt spray test based on ASTM B117. Liners and other steel components shall be galvalume steel. All seams shall be sealed to provide air tight casing.

B. Doors shall be insulated with the same construction as cabinet. Doors shall be fitted hinges with flush mounted door handles. The doors shall have one lockable handle as standard and the handles shall have a two stage opening for improved safety.
C. Units shall be tested in accordance with EN 1886 or equivalent and meet the following criteria:
   1. Casing air leakage = A
   2. Thermal transmittance = T3
   3. Thermal bridging factor = TB3
   4. Air tightness class L2
   5. Environmental Class C4
D. Units shall be designed so they can be unbolted and broken down into sections for access to restricted locations. All interconnecting wiring shall have quick connect harnesses at each section.
E. All dampers shall have extruded heavy gauge 6063 aluminum frame that includes jamb seals. Blades shall be airfoil shaped extruded aluminum and include rubber blade seals. Damper blades shall be insulated with expanded polyurethane foam providing R-2.29 and include a thermal break. Linkage shall be installed in the frame outside of the airstream.
F. All dampers shall include factory mounted, wired and tested actuators. Dampers shall be modulating or two position as required. Provide spring return dampers for outdoor air connections.

2.3 FILTERS
A. Unit shall include 2" pre-filter rack for the supply air and return air paths upstream of energy recovery heat exchanger. Filters shall be accessed through hinged filter access door. Supply one set of MERV 8 pleated filters.

2.4 FANS
A. Fans shall be quiet running, mounted on neoprene vibration isolation, and minimum 250,000 hour bearing lifetime rating.
B. Fan motors shall be premium efficiency, provided with VFDs or EC motors.
C. All fans shall be equipped with integral airflow monitoring system connected to the unit controller.
D. Provide means to easily remove fan-motor assembly for service through standard doors. Wiring must be quick connect fittings. Hard wiring will not be acceptable.
E. Fans should be designed such that all service can be performed in the field, including replacement of bearings.

2.5 ENERGY RECOVERY DEVICE
A. Units shall transfer both sensible and latent energy and be rated under AHRI 1060.
B. If a rotary heat exchanger is used, carry-over must not exceed 0.45% and be certified to EN308:1997.
C. Sensible heat recovery effectiveness shall be 80% minimum at design conditions and flow rates.

2.6 CONTROLS
A. A Unit shall include an integrated microprocessor based unit controller. The controls shall be located in the integral controls cabinet. All controls shall operate off a transformer from the main power supply for single point power connection. All internal controls and sensors shall be factory prewired and tested. The microprocessor shall have dual Ethernet ports with an internal firewall to allow remote access via third party without compromising the clients internal Network.
B. The control system will regulate temperatures, airflows and other functions as required. Unit controller shall be pre-programmed with factory test software for all possible functions. Controller shall utilize “plug and play” feature that will automatically load and operate any necessary algorithm based on components and accessories that are connected to the controller such as air flow monitors, damper actuators, fans, rotary energy recovery, water control valves, etc.
C. The controller shall provide the following, refer to sequence of operation for specific unit control sequences:
   1. Control of fans in both single and multi-zone VAV and constant airflow applications.
   2. CO_2 monitoring and control.
   3. Frost protection.
   4. Monitoring alarms, faults and maintenance points including filter changeout.
   5. Time and date schedules.

6. Building pressurization.

D. Include wireless capability that will allow the client to access remotely via Smart Phone or IPad or Similar device without supplemental software.
E. Controller shall be native BACnet certified and also include Modbus communication. Communication shall include monitoring, control, alarms, faults and maintenance information.
F. Provide factory installed and tested contactors, overloads, fusing, starters motor speed controllers for supply, and exhaust fans. Include all necessary control transformers.
G. Provide unit mounted non-fused disconnect switch with single point power connection.
H. Supply all necessary temperature and pressure sensors complete with plug in wiring harnesses for proper option of unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install DOAS unit in accordance with manufacturer's instructions, best practices, and all applicable building codes.
B. Install units with clearances for service and maintenance.
C. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.
D. Provide p-trap on condensate drains, drain to roof; use ASTM D 1785, Schedule 40 PVC pipe and solvent-welded fittings, same size as condensate drain connection.
E. Connect ducts to units with flexible connections.
F. Outside air intakes shall be minimum 10' from plumbing vents, flues, or building exhaust.
G. Engage factory authorized service technician to start up and commission units. Provide start up report to owner.

END OF SECTION

SECTION 238143 – INVERTER DRIVEN SPLIT-SYSTEM HEAT PUMP

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes both single zone split system inverter driven heat pumps and multi-zone split system variable refrigerant flow (VRF) heat recovery heat pump units consisting of separate evaporator-fan and compressor-condenser components, refrigerant piping, refrigerant flow control devices for heat recovery, and controls. Each VRF indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. The VRF system shall be capable of changing mode (cooling to heat, heating to cooling) with no interruption to system operation. Each indoor unit or group of indoor units shall be independently controlled.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
B. Sound Data: For each indoor and outdoor unit included in the schedule.
C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. The units shall be manufactured in a certified ISO 9001 and ISO 14001 facility.
C. All wiring shall be in accordance with the NEC.
D. The units shall be ETL listed and labeled.
E. ASHRAE Compliance:
   1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
   2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."
F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
G. The units shall be delivered with a full refrigerant charge of R-410a.

1.5 WARRANTY

A. VRF multi-zone and inverter driven single zone split system equipment shall be warranted by the manufacturer’s limited warranty for a period of one year from date of substantial completion. An extended warranty including 2 years parts and 10 years compressor shall be granted upon submission to the manufacturer and acceptance by the manufacturer of proper installation with documentation including:
   1. Selection output and layout of the VRF system.
   2. 150 minutes of operational history upon commissioning from the VRF service tool.
   3. Completed commissioning report as per the VRF equipment manufacturer.
B. During this period, any part failing to function properly due to faulty workmanship or material shall be repaired or replaced by the manufacturer’s and shall not include labor.
C. The VRF system and inverter driven split system equipment shall be installed by an installer trained by the VRF equipment manufacturer. Installation and commissioning training shall be required and performed by the manufacturer. The labor shall be warranted for a period of one year from date of substantial completion.

PART 2 - PRODUCTS

2.1 Performance Requirements:

A. Fan power shall be less than or equal to the fan power of the scheduled basis of design equipment.
B. Sound levels shall be less than or equal to the sound levels of the scheduled basis of design equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mitsubishi
   2. Or approved equal.

2.3 INDOOR UNITS

A. Wall-Mounted, Ductless Evaporator-Fan Components:
   1. The indoor unit shall be used with VRF components of the same manufacturer.
   2. Cabinet: Enameled steel panels with removable panels on front and ends, and discharge drain pans with drain connection.
   3. Multi-directional refrigerant (4 options) and condensate drain (2 options) connections shall be standard.
   4. The indoor unit shall attach to a separate back plate that will secure the unit to the wall. The back-plate will include piping and wiring templates to allow tidy installation with concealed piping, and wiring.
   5. Refrigerant Coil: Copper tube, grooved on inner surface, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240. Coil shall be factory pressure tested and designed for use with R-410A and factory charged with dry nitrogen gas.
   6. Fan Motors:
      a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
      b. Multitapped, 4 speed (low, med, high1 and high2) with internal thermal protection and permanent lubrication.
      c. Enclosure Type: Totally enclosed, fan cooled.
      d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
      e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
   7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
   8. Sweeping guide vane shall be factory installed allowing the ability to control the direction of airflow from side to side. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
   9. Air Filtration Section:
      a. General Requirements for Air Filtration Section:
         1) Comply with NFPA 90A.
         2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
         3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
      b. Disposable Panel Filters:
         1) Factory-fabricated, viscous-coated, flat-panel type.
         2) Thickness: 1 inch.
         3) Merv according to ASHRAE 52.2: 8.
         4) Electrical: The unit electrical power shall be single connection 208 volts, 1-phase, 60 hertz.
         5) The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).
   10. Controls:
         1) This unit shall use controls provided by the VRF system manufacturer to perform functions necessary to operate the system. Factory controls shall allow separate heating and cooling setpoints with individual deadbands and setbacks for heating and cooling. Factory controls shall allow the room temperature setpoint to be sensed at the room controller. Factory controls

shall be able to perform all of the functions described in the sequence of operations

B. 4-Way Ceiling Recessed Cassette with Grille Indoor Unit
   1. General: The four-way cassette style indoor unit shall recess into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
   2. Unit Cabinet:
      1) See plans for unit dimensions.
      2) The cabinet panel shall have provisions for a field installed filtered outside air intake.
      3) Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way throw.
   3. Fan:
      1) The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
      2) The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
      3) The indoor fan shall consist of three (3) speeds, Low, Mid, and High.
      4) The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
      5) The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.
   4. Filter:
      1) Return air shall be filtered by means of a long-life washable filter.
   5. Coil:
      1) The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
      2) The tubing shall have inner grooves for high efficiency heat exchange.
      3) All tube joints shall be brazed with phos-copper or silver alloy.
      4) The coils shall be pressure tested at the factory.
      5) A condensate pan and drain shall be provided under the coil.
      6) The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4” inches above the condensate pan.
      7) Both refrigerant lines to the indoor units shall be insulated.
   6. Electrical:
      1) The unit electrical power shall be single connection 208 volts, 1-phase, 60 hertz.
      2) The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).
   7. Controls:
      1) This unit shall use controls provided by the VRF system manufacturer to perform functions necessary to operate the system. Factory controls shall allow separate heating and cooling setpoints with individual deadbands and setbacks for heating and cooling. Factory controls shall allow the room temperature setpoint to be sensed at the room controller. Factory controls shall be able to perform all of the functions described in the sequence of operations

2.4 STANDARD HEAT PUMP OUTDOOR UNIT

A. General:

1. The outdoor unit shall be used with VRF components of the same manufacturer consisting of the outdoor unit, indoor units, y-branches and headers, and controls that allow for long communication wiring to support long piping runs totaling up to 3280 feet.
2. The outdoor unit shall be completely factory assembled, wired, and run tested.
3. The unit shall have a sound level rating no higher than 61 dBA.
4. All refrigerant lines from the outdoor unit to the indoor units shall be field insulated.
5. Unit control boards shall perform all functions required to effectively and efficiently operate the VRF system and communicate in a daisy chain configuration from outdoor unit to indoor units via RS485.
6. The outdoor unit shall have an accumulator.
7. The outdoor unit shall have a high pressure safety switch
8. The outdoor unit shall have over-current protection.
9. The outdoor unit shall have the ability to operate with an elevation difference of up to 328 feet above or below the indoor units.
10. The outdoor unit shall allow up to a total equivalent refrigerant piping length of 3280 feet.
11. The maximum length from outdoor unit to indoor unit shall be up to 656 feet without traps.
12. The outdoor unit shall be capable of operating in heating down to -4°F and up to 61°F ambient temperature without additional low ambient controls.
13. The outdoor unit shall be capable of operating in cooling down to 21°F and up to 110°F ambient temperature.
14. The outdoor unit shall have an oil separator and controls to ensure sufficient oil supply is maintained for the compressor.
15. Shall use R410A refrigerant.
16. All refrigerant lines from the outdoor unit to the indoor units shall be field insulated including at piping support locations.

B. Casing/Frame:
   1. Shall be constructed with galvanized steel, bonderized and finished with a powder coat baked enamel paint.
   2. The casing shall withstand the 960 hour salt spray test per ASTM B117.

C. Compressor:
   1. All outdoor unit frames shall be equipped with one VFD driven scroll compressor.
   2. A crankcase heater shall be factory mounted on all compressors.
   3. The compressor shall be completely variable from 5% to 105% of the rated capacity.
   4. The compressor shall be equipped with an internal thermal overload.
   5. The compressor shall be mounted to avoid the transmission of vibration.

D. Fan:
   1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fans capable of normal operation from 0” to .24” WG external static pressure via dipswitch.
   2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be variable speed with a maximum speed up to 950 rpm.
   3. All fan motors shall be mounted for quiet operation.
   4. All fans shall be provided with a raised guard to prevent human and debris from contact with moving parts.
   5. The outdoor unit shall have vertical discharge airflow.

E. Coil:
   1. The outdoor coil shall be of nonferrous construction with louvered fins on copper tubing.
   2. The coil fins shall have a factory applied corrosion resistant Gold Fin with hydrophilic silica gel coating which passes an ASTM B117 corrosion resistance test of 1000 hours.
   3. The coil shall be protected with an integral metal guard.
   4. Refrigerant flow from the outdoor unit shall be controlled by means of a digitally controlled inverter driven scroll compressor.

F. Electrical:
   1. Verify outdoor unit power with mechanical and electrical drawings.

2. The outdoor unit shall be capable of satisfactory operation within voltage limits of +/- 10% rated voltage.
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units, heat recovery box and the outdoor unit shall be field supplied 24VDC completed using a 2-conductor, stranded, shielded cable for the RS485 daisy chain communication.

2.5 Branch CIRCUIT (BC) controllers

A. General: If the manufacturer uses a branch controller, it shall meet the following specification. The BC (Branch Circuit) Controllers shall be specifically used with R410A R2-Series systems. These units shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.

B. BC Unit Cabinet:
1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant
1. R410A refrigerant shall be required.

D. Refrigerant valves:
1. The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and up to three indoor units. Branches may be twinned to allow more than 54,000 BTUH.
2. Each branch shall have multiple two-position valves to control refrigerant flow.
3. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.
4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

E. Integral Drain Pan: An integral condensate pan and drain shall be provided.

F. Electrical:
1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253V (230V/60Hz).
3. The BC Controller shall be controlled by integral microprocessors.
4. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.6 ACCESSORIES

A. Manufacturer shall provide all controls required to operate the system as described in the sequences of operation as specified in Division 23 Section "Sequence of Operations for HVAC Controls."

B. Thermostat: See Schedule.

C. Central controller to integrate indoor and outdoor units, EB-50 or approved. Controller shall include digital input/digital output board that shall allow the VRF controller to control the operation of supply and exhaust fans in the energy recovery ventilation dedicated outdoor system.

D. Bacnet Controller: See diagrams.

E. Coordinate with CKSD IT department for network connection with VRF controller.

F. Coordinate with Controls contractor for integration with DDC system.

G. Automatic-reset timer to prevent rapid cycling of compressor.

H. Drain Hose: For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install compressor-condenser components on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.
D. Install seismic restraints.
E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch See Division 23 0500 Section "Common Work Results for HVAC."
F. All piping connections shall be brazed. Install piping to allow access to unit.
G. All piping, power wiring, and control wiring shall be run in interior walls so that the services are not visible.
H. Indoor fan coil units with condensate pumps shall be wired to lock out cooling operation when condensate pumps have failed.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
C. All piping, power wiring, and control wiring connections shall be made behind the unit cabinets, so that the connections are not visible.
D. Duct Connections: Duct installation requirements are specified in Division 23 Section "HVAC Ducts and Casings" Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
B. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
C. Remove and replace malfunctioning units and retest as specified above.
D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 260010 – EVCAVATION AND BACKFILL FOR ELECTRICAL UNDERGROUND UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 GENERAL INCLUDES

A. Excavation and Associated Grading.
B. Trenching and Trench Protection.
C. Backfilling and Compaction.
D. Verification of Existing Utilities.
E. Protection of utilities.

1.3 QUALITY ASSURANCE

A. Inspection of Job Conditions: Prior to starting work and during work, the installer shall examine the work by others, site and job conditions under which excavation, trenching, and backfilling for underground utilities work will be performed, and notify the General Contractor in writing of unsatisfactory conditions have been corrected in a manner acceptable to the installer.
B. Codes and Standards: Comply with requirements of the following codes and standards (Latest Edition) except as modified herein:
   1. International Conference of Building Officials, “International building Code”.
   2. Local requirements for all utility work.
   3. OSHA and WISHA regulations.
   4. APWA Standard Specifications.
   5. National Electrical Code – NFPA 70.

1.4 RESPONSIBILITY

A. The Contractor is solely responsible for compliance with the requirements of the drawings, specifications, local codes, proper construction coordination with work of other trades, and protection and worker’s safety. Contractor shall advise Engineer of any discrepancy in, or disagreement with the specifications and/or drawings prior to starting work and not proceed until issue is resolved. Commencement of work shall indicate Contractor’s acknowledgement of his expertise in this type of work. Any delay resulting from failure to comply with this procedure will not be basis for an extension of the completion date.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced.

D 422-63	Particle Size Analysis of Soils
D 423-66	Liquid Limit of Soils.
D 424-59	Plastic Limit and Plasticity Index of Soils.
D 1557-78	Moisture Density Relations of Soils using a 10 lb. (4.54kg) Rammer and 18 inch (457mm) Drop.
D 2167-66	Density of Soil In-Place by the Rubber Balloon Method.
D 2217-66	Wet preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Contents.
D 2487-69	Classification of Soils for Engineering Purposes.
D 2922-81	Test methods for Density of Soil and Soil-Aggregate in Place by nuclear Methods (Shallow Depth).

E 548-79 Generic Criteria for Use in the Evaluation of Testing and Inspection Agencies.

PART 2 - MATERIALS

2.1 SATISFACTORY MATERIALS

A. Materials classified as ASTM D2487, Unified Soil Classification System as SW, SP, GW, and GP are satisfactory for backfill use. Materials classified as SP-SM, GP-GM, GW, GC and ML are also satisfactory for backfill use provided that they contain moisture contents suitable for the intended use and are reasonably free or organic matter. Native material, not considered unsatisfactory as specified below, may comply. Except no material shall have any object with dimensions exceeding 2 inches and no object shall be sharply angular.

B. Contractor shall include all costs associated with testing in bid proposal.

2.2 UNSATISFACTORY MATERIALS

A. Materials classified in ASTM D2487, Unified Soil Classification System as PT, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse and all materials containing excessive organic matter or having moister contents which are not suitable for the intended use, or having objects with dimensions exceeding 2 inches (boulders, etc.).

2.3 UNSTABLE MATERIALS

A. Unstable material shall consist of material too wet to properly support the utility conduit or appurtenance structure, and material identified as unsuitable in the National Electrical Code 300-5(F).

2.4 GRAVELLY SAND BORROW MATERIAL

A. Gravelly sand borrow material to provide backfill, or replace unsuitable soil, shall meet the requirements of SW, SP, GW, and GP materials, except that the maximum percentage passing the No. 200 sieve shall not exceed 5% based on the soil fraction passing the U.S. No. 4 sieve and not contain discrete particles greater than 2 inches in diameter.

2.5 DEGREE OF COMPACTION

A. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557, Method D. Minimum compaction requirements shall be as specified in PART 3.

2.6 DRAINAGE GRAVEL

A. Shall be ¾ inch washed gravel with no more than 2% passing ½ inch sieve opening.

2.7 SPECIAL BEDDING AND INITIAL BACKFILL MATERIAL

A. Minus 3/8 inch washed pea gravel.

PART 3 - EXECUTION

3.1 EXCAVATION

A. If workers enter any trench or other excavation four or more feet in depth that does not meet the open pit requirements of WSDOT Section 2.09.3 (3)B, it shall be shored and cribbed. The Contractor alone shall be responsible for worker safety. All trench safety systems shall meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW.

B. Excavation of every description and of whatever substances encountered shall be performed to allow the installation of all utilities at the lines and grades as required. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from

contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material.

C. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to owner.

D. Excavated material not required or not satisfactory for backfill shall be removed for the site and shall be disposed of off site, at the Contractor's expense, at the Contractor's waste area. Any excess satisfactory excavated materials shall not be mixed with unsatisfactory materials. Unsatisfactory materials shall not cover available suitable materials or be disposed of in such a manner as to interfere with subsequent borrow operations.

E. Grading shall be done as many as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Unauthorized over-excavation shall be backfilled in accordance with paragraph 3.5 BACKFILLING at no additional cost to the owner.

F. The Contractor shall provide dewatering as required for installation of underground work.

3.2 TRENCH EXCAVATION

A. The trench excavation shall meet the requirements of the National Electrical Code and local utility standards.

B. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the conduit and for bedding. Stones of 2 inches or greater in any dimension, or as recommended by the conduit manufacturer, whichever is smaller, shall be removed to avoid point bearing.

C. Removal of Unsuitable Material: Where unsuitable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph 3.05 BACKFILLING. When removal of unsuitable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

D. Bedding: the bedding surface for the conduit shall provide a firm foundation of uniform density throughout the entire length of the conduit. The conduit shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular conduit or to the lower curved portion of conduit arch for the entire length of pipe or arch. When necessary, the bedding shall be taped. Provide bedding using pea gravel where noted on the drawings.

3.3 EXCAVATION FOR APPURTENANCES

A. Excavation for manholes, handholes or similar structures below grade shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.4 JACKING, BORING AND TUNNELING

A. Unless otherwise indicated, excavation shall be by open cut, except that sections of a trench may be jacked, bored, or tunneled if the raceway, cable or duct can be safely and properly installed and backfill can be properly tamped in such sections placed.

3.5 BACKFILLING

A. Backfill material shall be compacted to 6” layers and as specified in Paragraph 3.06.
   1. Trench Backfill: Trenches shall be backfilled to finish grade.
   2. Replacement of unstable Material: Unstable material removed from the bottom of the trench of excavation shall be replaced with select granular material or gravel borrow placed in layers not exceeding 6 inches loose thickness.
   3. Bedding and Initial Backfill: Bedding shall consist of satisfactory materials. Initial backfill shall be in 6 inch lift.

3.6 COMPACTION

A. Each layer of fill, or excavated sub grade, shall be compacted to at least 95%, per ASTM D1557, of laboratory maximum density. Compaction shall be accomplished by approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers, or other approved compaction equipment.

3.7 PROTECTION

A. Newly graded excavation or bedded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades re-established to the required elevations and slopes.

END OF SECTION

SECTION 260126 – MAINTENANCE TESTIGN FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Perform tests of the electrical system to assure code compliance and proper system operation according to the intent of the contract documents. Retain the services of approved testing agency(s) to comply with the ground fault protection systems and medium voltage testing requirements of this section.

B. Applicable Codes, Standards & References for Tests:
All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.
1. National Electrical Code - NEC
2. National Electrical Manufacturer's Association - NEMA
3. American Society for Testing and Materials - ASTM
4. Institute of Electrical and Electronic Engineers - IEEE
5. National Electrical Testing Association - NETA
6. American National Standards Institute - ANSI
7. State and Local Codes and Ordinances
8. Insulated Cable Engineers Associate - ICEA
9. Association of Edison Illuminating Companies - AEIC

1.3 CIRCUIT TESTS

A. The Contractor shall perform routine insulation resistance, continuity and grounding tests for all distribution and utilization equipment prior to their connection and energization. A standard megger-type instrument shall be used to demonstrate that insulation values are acceptable, ground system is continuous, and the neutral system is isolated from the grounding system except at the systems' single ground point.

B. System defects, indicated by the circuit tests, shall be corrected. Tests shall be repeated until satisfactory results are obtained.

1.4 GROUNDING TEST

A. Measure the ohmic value of the Electrical Service Entrance "System Ground" with reference to "Earth Ground" using multiple terminal, fall of potential methods and suitable test instruments.

B. Maximum resistance to ground shall be less than 10 ohms unless lower values are specified in the contract documents. Notify the Architect/Engineer if this resistance value is not obtained for the initially installed system; and then provide corrective measures required to reduce ground resistance to less than 10 ohms.

1.5 MOTOR AND EQUIPMENT TESTS

A. Verify proper rotation of all motors before placing into service.

B. Measure and record electrical data for each motor installed under this contract. Data shall include these items:
1. Motor description
2. Controller description
3. Motor nameplate amperes
4. Actual measured motor running amperes

5. Overload heater manufacturer and catalog numbers
6. Overload heater ampere range
7. Voltage (measured) and phase

C. Motor controller overload heaters shall be sized to the actual motor nameplate full load current; do not oversize overload heaters.

1.6 PHASE BALANCE TESTS

A. Verify the balance of the electrical system's phase currents. Reassign load connections if necessary, to obtain a balance is acceptable to the Engineer.

1.7 ARC FLASH AND PERSONNEL PROTECTIVE EQUIPMENT (NEC 110-16)

A. Contractor shall prepare an arc flash and Personnel Protective Equipment study. Contractor shall provide labeling of the electrical equipment within the facility. All labels shall have a permanent marked date of the label installation per National Electrical Code requirements.

1.8 SHORT CIRCUIT AND PROTECTIVE DEVICE COORDINATION STUDY

A. Contractor shall prepare a short circuit and protective device coordination study of the electrical equipment within the facility per National Electrical Code requirements.

PART 2 - PRODUCTS

2.1 MATERIALS AND INSTRUMENTATION

A. Contractor and/or testing agency shall supply all apparatus and materials required for indicated tests.

B. Contractor shall include all costs associated with testing in bid proposal.

2.2 TEST REPORT(S)

A. Furnish electronic PDF copy of test reports, as specified herein, for inclusion into the project operation and maintenance manuals. Each test report shall include the following items:

1. Name, address and telephone number of the testing agency.
2. Name(s) of personnel conducting the tests
3. Type of test
4. Description of test procedure
5. List of items tested
6. List of actual test equipment including make, model(s), serial number(s) and calibration date(s) as applicable.
7. Test results
8. Conclusion and recommendations
9. Appendix, including appropriate test forms

PART 3 - EXECUTION

3.1 TESTING PROCEDURE

A. Submit a copy of test procedure(s) to the Engineer prior to testing.

B. All tests shall be conducted according to applicable industry standards.

3.2 SCHEDULING

A. Notify Architect/Engineer and Owner at least five (5) working days prior to performance of any test.

END OF SECTION

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 GENERAL CONDITIONS

A. Bidding documents including Division 1 General Conditions, Supplementary General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical.

B. General requirements for materials and installation methods.

1.3 DEFINITIONS

A. The term "provide" shall mean furnish, install and connect equipment and materials complete in operating condition.

B. The term "approved" as used herein shall mean the written approval of the Engineer.

C. The term "Contractor" as used herein shall mean the organization responsible for accomplishing all work within the contract documents. The plural term "contractors" as used herein shall include all of the trade organizations that comprise the project workforce.

D. The term "drawings" as used herein shall mean all contract drawings for all divisions of work.

E. NEC means National Electrical Code.

F. The term "code" as used herein shall mean all applicable National, State and local codes.

1.4 SCOPE OF WORK

A. The Electrical work consists of furnishing, installing, testing and placing in satisfactory operation all equipment, materials, devices and appurtenances, necessary to provide complete systems according to the intent of the Drawings and Specifications. In general, this includes all labor, materials, equipment, tools, etc. to complete the electrical work.

B. Electrical requirements are not limited to electrical drawings and specifications. There is additional electrical work required to be included in the bid, indicated on the architectural, structural, landscape, civil, kitchen and mechanical drawings. Additional electrical work required in the bid is also located in the specifications. Contractor shall review all architectural, structural, landscape, civil, kitchen and mechanical, drawings and specifications for additional electrical requirements and information.

1.5 INTENT OF DRAWINGS

A. The Electrical drawings are intended to serve as working drawings for general layout. Equipment, receptacles, tele/data, switches, panels, lights, disconnects and raceways are partially diagrammatic and do not necessarily indicate actual routings or all appurtenances required for a complete installation.

B. The drawings and specifications are complementary. What is called for in either is binding as if called for in both. In case of conflict within the drawings, specifications or between drawings and specifications the Architect/Engineer will select the method to be taken.

C. Take all working dimensions, device heights, door swings and the like from architectural drawings and check them against those shown or scaled on the electrical drawings. In the event of conflict, report discrepancies to the Architect/Engineer for resolution before proceeding with the work.

D. Minor changes in the locations of raceways, devices and the like, from those shown on the plans, shall be made without extra charge if so, directed by the Architect/ Engineer before installation.

E. Motor horsepower and apparatus wattages indicated on the plans are estimated requirements of equipment furnished under other Divisions of this contract. Advise the Architect/Engineer in writing of any deviations in actual equipment supplied that affect the electrical installation.

1.6 MANUFACTURERS' RECOMMENDATIONS

A. Make all installations in strict accordance with manufacturers' published recommendations and details. All equipment and materials recommended by them shall be considered as part of this contract.

1.7 WORK RELATED TO OTHER DIVISIONS

A. TEMPORARY CONSTRUCTION POWER AND LIGHTING

1. Contractor is responsible for all costs associated with removal of the temporary construction service meter.
2. Provide, maintain and remove, when no longer required, temporary electrical construction wiring from the construction service meter to and within the building for the number of lights and receptacles required. Wiring to construction sheds, outdoor construction machinery, and temporary exterior work areas shall be the responsibility of individual contractors.
3. Provide and maintain construction lighting with portable wiring and temporary energization of the permanent building wiring, complete with lamps. Suitable construction lighting shall be provided in each room where lighting is required for any of the contractors on the job. See NEC ARTICLE 305. Temporary wiring.
4. Contractor is responsible for re-lamping construction lighting after the initial lamping.
5. Provide adequate feeders, circuit breakers and duplex 15-ampere 120-volt receptacles at locations as required. Note: 120 volt construction receptacles shall provide Ground Fault circuit protection in accordance with applicable WISHA safety standards.
6. Portable power cords from the outlets specified herein shall be the responsibility of individual contractors using the cords.
7. Responsibilities outlined in the Paragraph Temporary Construction Power and Lighting are delineated herein to avoid conflicts between the various contractors. Assume all responsibility for safety, Electrical and Safety Code compliance, performance and adequacy of the construction power and lighting installation. The Architect and Engineer assumes no responsibility for the performance or safety and will not inspect nor design this temporary installation as it is not part of the completed structure.

B. MECHANICAL CONTROL WIRING

1. See Division 23.

C. EQUIPMENT FURNISHED BY OTHERS

1. All electrical equipment furnished for this project shall be coordinated with the drawings to insure correctness of Voltage, Phase and Ampacity. Equipment served by single circuit or feeder shall be provided with appropriate internal wiring including fusing of multiple circuits as required by code.
2. Contractors supplying equipment incompatible with the designed electrical service shall be responsible for arranging and providing necessary changes in their supply wiring to suit the equipment.
3. Verify dimensions of equipment to be furnished by others to insure correct clearances and connections.
4. Control Voltages shall not exceed 120 volts. Provide control transformers for higher line voltages. Control transformers shall be connected from phase to neutral.

1.8 SUPERVISION AND COORDINATION

A. Coordinate work with local power, telephone, cable and data utilities to ensure compliance with their specific requirements. Before starting work, contact both power and telephone utilities and make arrangements for their services to this project.
B. Contact Electrical Inspection and obtain a permit before starting work. Electrical plans have been submitted for plans review and will be available with payment for electrical permit.
C. Maintain adequate supervision of Division 26 work and have a responsible person in charge at the site any time work is in progress or when necessary for coordination with other trades.
D. Schedule work to best serve the interests of the Owner. Lay out work by referring to Civil, Landscape, Architectural, Structural, Mechanical and other Contractors to anticipate their movements. Cooperate with the other contractors on the job and coordinate work to avoid interference with them.
E. Determine a satisfactory space allocation arrangement where electrical material is installed in proximity to work of other trades. No extra payments will be allowed to relocate work that interferes with that of other trades.

1.9 CODES AND REGULATIONS

A. All work shall conform to current applicable National, State and local Codes; these shall be regarded as the minimum standard of quality for material and workmanship. Contractor shall provide all Labor and Material that may be required for compliance with Code Requirements or Code Interpretations, although not specifically detailed on the Drawings or in the Specifications. Contractor shall become familiar with all the following codes prior to bidding.

ASTM	American Society for Testing and Materials
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code
WAC	Washington State Administrative Code
NESC	National Electrical Safety Code
NEMA	National Electric Manufacturers Association
NFPA	National Fire Protection Association
UL	Underwriters Laboratories, Inc.
ICEA	Insulated Cable Engineers Associations
CBM	Certified Ballast Manufacturers
ETL	Electrical Testing Laboratories
IFC	International Fire Code
IBC	International Building Code

B. Nothing in these Drawings and Specifications shall be construed as permitting work not conforming with governing codes.
C. The Contractor shall not be relieved from complying with any requirements of these contract documents which may exceed, but not conflict with, requirements of the governing codes.
D. Contractor shall include in bid all costs to have a Department of Labor & Industries approved firm to evaluate the installation safety, and compliance with code as required per WAC 296-40-100 for any equipment specified or furnished that is not UL labeled.
E. For equipment furnished by others that is not UL labeled the contractor shall not connect the equipment to the electrical system until receiving written approval by the electrical authority having jurisdiction.

1.10 PERMITS & FEES

A. Obtain and pay all fees for licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work and provide inspectors with all necessary assistance.

1.11 WORKMANSHIP

A. All work shall be done by competent craftsmen skilled in the specific work to be done. Equipment shall be installed in a neat and workmanlike manner following the best practice of the trade.

1.12 ITEMIZED COST BREAKDOWN

A. Furnish the Engineer with an itemized contract cost breakdown to allow evaluation of partial payment requests. The cost breakdown shall categorize major items of the contract such as: Job organization and setup, conduit system, primary switchgear, transformers, secondary panel gear, service and feeder wiring, branch circuit wiring, lighting fixtures, wiring devices, trim, fire alarm and special systems.

1.13 OPERATING INSTRUCTIONS

A. Fully instruct the Owner's designated representatives in the operation and maintenance of all components of the electrical system upon completion of the work and after all tests and final inspection(s) by the Authority(s) Having Jurisdiction.

B. All costs for contractor's instruction are to be included in the bid proposal. These costs are in addition to contractors' costs for commissioning.

C. Instructors shall be contractor's superintendents or foremen knowledgeable in each system and equipment suppliers' representatives for special systems.

D. Refer to Section 01 7700 Closeout Procedures.

1.14 AS-BUILT RECORD DRAWINGS

A. Continuously maintain a set of AS-Built Drawings to indicate all significant deviations from the original design and the actual placement of equipment and underground conduits. (Location of conduit stubouts shall be dimensioned from accepted reference lines). Changes shall be shown with red colored pencil while work is in progress. This "As-Built" set shall be clearly marked: "AS-BUILT RECORD DRAWINGS - Do Not Remove From Office."

B. Quarterly "As-Built" review refer to 01 7700 Closeout Procedures.

C. "As-Built Record Drawings" and "Corrected to As-Built" prints shall be delivered to the Engineer for transmittal to the Owner.

1.15 ELECTRICAL EQUIPMENT OPERATION AND MAINTENANCE (O&M) MANUALS

A. Refer to Section 01 7700 Closeout Procedures.

1.16 FINAL INSPECTION

A. Refer to Section 01 7700 Closeout Procedures.

1.17 FINAL ACCEPTANCE

A. Refer to Section 01 7700 Closeout Procedures.

1.18 GUARANTEE

A. The Division 26 Contractor shall provide written guarantee to repair or replace (without additional expense) any defective materials or workmanship which become evident within a period of two (2) year after final acceptance or for such longer period as elsewhere specified. All warranty work shall be to the satisfaction of the Owner.

B. Any material guaranteed by a specific manufacturer for a period in excess of two (2) years shall be specifically noted on the Owner's written guarantee.

C. The Division 26 Contractor will not be expected to perform normal maintenance, such as replacement of incandescent lamps, etc., 60 days beyond date of Beneficial Occupancy by Owner or Final Acceptance, whichever date is earlier.

D. Refer to Section 01 7700 Closeout Procedures.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall be new, free from defects, of the quality specified herein and on the drawings. Materials shall be designed to ensure satisfactory operation and rated life in the prevailing environmental conditions where they are being installed. They shall be listed by Underwriter's Laboratories or a recognized testing laboratory for use under these conditions.
B. Each type of material shall be of the same make and quality throughout the job. The materials furnished shall be the latest standard design products of manufacturers regularly engaged in their production.

2.2 TECHNICAL DATA

A. Technical information contained herein relies entirely on tests and ratings provided by manufacturers who are solely responsible for their accuracy. The Engineer, by use of this information in no way implies the results of published manufacturer’s information has been verified.

2.3 AS SPECIFIED EQUIPMENT

A. This specification generally lists only one make and model number for each item of equipment or material required for the project. This is not intended to be restrictive but is intended to indicate the standard of quality, design and features required. In addition, the listed product is the basis of the design regarding physical size, electrical power requirements and performance. The product so identified is designated "as specified."

2.4 SUBSTITUTION OF MATERIALS

A. Listing of approved materials is not intended to prevent acceptance of other materials provided the substitute products are submitted for approval and have been approved in accordance with the Substitution of Materials requirements.
B. Approval Prior to Installation
    1. All substitution requests shall be made on the substitution request form.
    2. The Contractor shall be responsible for a substitute item suiting the space limitations shown and for any additional installation costs incurred by the substitution.
    3. Approval of substitute materials shall not be construed as authorizing any deviation from the contract drawings and specifications except where such deviation is clearly described in writing on the substitution request form and is approved in writing by the Engineer.
    4. Requests shall clearly define and describe the proposed substitute product. Such requests shall be accompanied by samples, record of performance, certified test reports and such additional information as the Engineer may require to satisfactorily evaluate the substitute product(s).
C. Approval Prior to Bid Opening
    1. Bidders or vendors may submit prior approval requests for substitute materials that are similar in appearance, quality and performance to those specified herein or on the drawings.
    2. All requests shall be made in writing at least ten (10) days prior to date of bid opening using the substitution request form. Telephone requests and written requests for approval received in the engineer’s office less than ten (10) days prior to bid opening will not be accepted.
    3. Approved substitute materials will normally be included in addenda published prior to bid opening.
D. Approval After Contract Award: Substitute products will be considered after contract award only under these conditions:
    1. Non-Availability of Specified Materials: The Contractor shall have placed orders for

specified materials within ten days after notice to proceed and received written confirmation of non-availability from the supplier(s). The reason of non-availability shall be beyond the contractor's control such as: discontinuation of manufacture, strikes and acts of God.

2. Contract Price Adjustments: The Contractor may submit substitution requests for Owner cost savings. All substitute request forms submitted after award of contract shall clearly indicate the proposed contract price change or the request will not be considered.
3. Where Permitted in the Specifications: For items where "approval prior to bidding" is not required in these specifications. It shall be the contractors' responsibility to show that a substitute item is equal or superior in performance and quality to the specified item.

E. No Substitute:
1. It is the intent of this specification to require specific materials to be compatible with the existing installation. Certain materials and systems, consequently, are indicated "No Substitute" and shall be provided as specified.

2.5 COMPLETE SYSTEMS

A. All systems specified herein and shown on the drawings shall be complete and operational in every detail. Mention of certain materials in bidding documents shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide a complete and operable system.

2.6 SUBMITTALS

A. Purpose of Submittals
1. Submittals processed by the Engineer are not change orders. The Contractor, by the submittal process, demonstrates an understanding of the design concept by indicating equipment and materials intended to be provided and fabrication/installation methods intended to be utilized to meet all requirements of the contract documents.
2. The Engineer's review is for general conformance with the design concept and the contract documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the contract documents.

B. Submittal items: Submittals shall include, but not be limited to the following items:

Raceways
Duct Bank Spacers
Duct Bank Warning Tape
Wiring Devices
Disconnects
Lighting Standards and Poles
Lighting Fixtures
Time Switch
Nameplates
Wires and Cables Fuses
Fused Disconnects
Protective Device Coordination Study
Arc Flash and PPE Study
Short Circuit Study
Switchboard and Panels with Coordination Study
Splicing Kits
Labels
Pre-cast Concrete Handholes/Covers

Items Requested by Engineer

C. Submittal Format
1. A transmittal letter with reference identification (i.e., Electrical Submittal No. 1, material lists and catalog data, etc.) shall accompany all submittals.
2. Provide electronic PDF copy of each submittal items.
3. All information contained in the electronic PDF shall be grouped by specification

sections.

D. Submittal Completeness
   1. The Contractor shall make every effort to ensure the completeness of the initial submittal. Availability of certain shop drawings and catalog materials, however, may prevent this. Submittal shall not be delayed past specified time periods to await delivery of the missing items. The Contractor, instead, shall identify missing items on the transmittal letter and provide index listings and divider tabs for later insertion of these materials into the completed submittal brochure.

E. Engineer's Selection of Materials for Installation: The Engineer may select specified items that the Contractor shall provide, without change in contract price or time of completeness, under these circumstances:
   1. Late and/or Unqualified Partial Submittals: Submittals must be made within the specified time periods; all partial submittals shall indicate manufacturer(s) catalog numbers, pertinent technical information and status of missing items.
   2. Failure to follow Re-submittal Procedures: Contractor, within 14 days after the Engineer rejects any items, shall re-submit new materials for approval.
   3. Materials have been submitted and rejected twice by the Engineer.

F. Contractor's Responsibilities: The Contractor is responsible for all submittal details, accuracy of quantities and dimensions, selection of fabrication processes and techniques of assembly.
   1. The Contractor shall furnish equipment/material suppliers with all Drawings and Specifications pertinent to their work.
   2. The Contractor shall review, stamp and sign all submittals and shop drawings, prior to submitting shop drawings to the Engineer for review. Contractor shall correct them to ensure compliance with the specifications and drawings. Obtain Engineer's written approval before manufacture is started on any special equipment.
   3. Deviation from Shop Drawings in fabrication and/or installation of equipment is not permitted unless proposed changes are clearly noted in writing by the Contractor and approved in writing by the Architect/Engineer at the time of submittal.
   4. Maintain at least one complete approved submittal brochure on the jobsite for reference during construction.

2.7 ELECTRICAL EQUIPMENT IDENTIFICATION

A. General: These items shall be provided with nameplates:
   1. All motors, motor starters, pushbutton stations, control panels and time switches.
   2. Disconnect switches, switchboards, panelboards, time clocks, low voltage control panels and circuit breakers, contactors, and relays in separate enclosures.
   3. Wall switches controlling receptacles, lighting fixtures or equipment where the receptacles are not located within sight of the controlling switch.
   4. Special systems shall be properly identified at outlets, junction and pull boxes, terminal cabinets and equipment racks.

B. Nameplate Inscription
   1. All nameplates shall adequately describe the function or operation of the identified equipment as required.
   2. Panelboard and Switchgear nameplates shall include equipment designation, voltage and phase of supply, i.e., Panel A, 208/120V, 3 phase, 4 wire.
   3. Nameplate designations shall be consistent for all components of a particular piece of equipment, such as starter, disconnect switch, Push Button control station(s) and the like.

4. Contractor shall submit a complete list of nameplates for approval.

C. Nameplate Construction
1. Nameplates shall be laminated phenolic plastic with minimum 3/16" high black engraved characters on white background (alternate background colors shall be provided as noted in the specifications or drawings for special applications).
2. Nameplates shall be securely fastened to the equipment with No. 4 round-head phillips, cadmium plated steel, self-tapping screws. Contact cement adhesive only is not acceptable.
3. Motor nameplates may be non-ferrous die-stamped metal, minimum 0.03 inch thick, in lieu of separate phenolic nameplate. Device plates may be identified by engraving directly on the plate. All engraved or stamped lettering shall be filled with contrasting enamel.

PART 3 - EXECUTION

3.1 PROTECTION OF WORK

A. Protect all work, wire, cable, materials and equipment installed under this division against damage by other trades, weather conditions or any other causes. Equipment found damaged or in other than new condition will be rejected as defective.

B. Switchgear, panels, light fixtures and electrical equipment shall be kept covered or enclosed to exclude moisture, dust, dirt, plaster, cement, or paint and shall be free of all such contamination before acceptance. Enclosures and trims shall be in new condition, free of rust, scratches or other finish defects. Properly refinish in a manner acceptable to the Engineer if damaged.

C. Keep conduit and raceways closed with suitable plugs or caps during construction to prevent entrance of dirt, moisture, concrete or foreign objects. Raceways shall be clean and dry before installation of wire and at the time of acceptance.

D. Make up and insulate wiring promptly after installation of conductors. Wire shall not be pulled-in until raceways are complete, all bushings are installed, and raceway terminations are completed. Wire shall not be pulled into conduit embedded in concrete until after the concrete is placed and forms are removed.

3.2 CUTTING AND PATCHING

A. Obtain permission from the Architect/Engineer prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or saws except where space limitations prevent the use of such equipment.

B. Penetrations of fire rated elements shall be carefully made to maintain that rating after the installation is complete. See Section 01 3100 and Section 07 8400.

C. All construction materials damaged or cut into during the installation of Division 26 work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.3 EXCAVATIONS

A. The contractor shall be fully responsible for the location and protection of all existing utilities. The contractor shall verify all utility locations prior to construction by calling the underground locate line at 1-800-424-5555 a minimum of 48 hours prior to any excavation. The contractor will also be responsible for maintaining all locate marks once the utilities have been located.

B. All excavations are to be so conducted that no walls or footings shall be disturbed or injured in any way.

C. Remove all surplus earth not needed for backfilling and dispose of same as appropriate at a licensed disposal facility.

3.4 PAINTING

A. Painting in general will be covered under another Division of this specification. Items furnished under this Division scratched or marred in shipment or installation are to be refinished by the Contractor to the satisfaction of the Engineer.
B. Junction boxes for telecom shall be painted blue. Fire alarm junction boxes shall be painted red.

3.5 CLEAN UP

A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done at sufficient frequency to minimum hazard to the public, other workmen, the building and the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, wiring devices, coverplates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces or apparatus shall be removed and new finish equal to the original applies.

3.6 LABELING

A. Clearly and properly label the complete electrical system, as specified herein, to indicate the loads served or the function of each item of equipment connected under this contract.
B. Control circuits shall utilize combinations of colors with each conductor identified throughout using wrap around numbers or letters. Identification shall be consistent with the contract drawing requirements and operation and maintenance shop drawings.
C. Labels shall be provided on all disconnects, combination motor starter, and junction boxes indicating the specific panel and branch circuit utilized. Do not provide circuiting labels on light switch and receptacle cover plates

3.7 MECHANICAL EQUIPMENT CONNECTIONS

A. Provide complete electrical connections for all items of equipment, including incidental wiring, materials, devices and labor necessary for a finished working installation.
B. Mechanical/Electrical equipment connection coordination shall be as follows:

FURNISHED ITEM	INSTALLED BY	POWER BY	CONTROL WIRING BY	WIRING BY
Mechanical Equipment Motors	MC	MC	EC	MC
Fused & Unfused Disconnect Switches, Thermal Overload & Heaters	EC	EC	EC	--
Motor Starter & Overload Heaters	EC	EC	EC	MC
Manual Operating & Speed Switches	MC	EC	EC	MC
Control Relays & Control Transformers	MC	MC	EC**	MC
Low Voltage Thermostats	MC	MC	EC**	MC
Temperature Control Panels	MC	MC	EC**	MC
DDC Panels	MC	MC	EC**	MC
Motor & Solenoid Valves, Damper Motors, PE & EP Switches	MC	MC	--	MC
Fire/Smoke Dampers (Actuators)	MC	MC	EC***	MC/EC*
Duct-Mounted Smoke Detectors	EC	MC	--	MC/EC*

MC = Division 23
EC = Division 26

* Motor interlock by MC, Fire Alarm System Interconnection by EC.
** EC shall provide conduit and wire from nearest un-switched 120V circuit location. Label on "as built" drawings.
*** EC shall provide conduit and wire from nearest 120V panel. Connect to spare circuit breaker and label on "as-built" drawings.

3.8 SUPPORT AND ALIGNMENT

A. Each fastening device and support for electrical equipment, fixtures, panels, outlets and cabinets shall be capable of supporting not less than four times the ultimate weight of the objects fastened to or suspended from the building structure.
B. Install panels, cabinets and equipment level, plumb, and parallel with structural building lines. Switchgear, panels and all electrical enclosures shall fit neatly without gaps, openings or distortion. Properly and neatly close all unused openings with approved devices.
C. Fit surface panels, devices and receptacles with neat, appropriate trims, plates or covers, (without over-hanging edges, protruding corners or raw edges) to leave a finished appearance.
D. All junction boxes, pull boxes or other conduit terminating housings located above a suspended ceiling shall be securely suspended from structure or ceiling grid system to prevent sagging or swaying.

3.9 NOISE CONTROL

A. Back-to-back or straight-through installation of wall or partition boxes is not permitted to minimize noise transmission between occupied spaces.
B. Contactors, transformers, starters and similar noise producing devices shall not be placed on walls which are common to occupied spaces. Where such devices must be mounted on walls common to occupied spaces, they shall be shock mounted or isolated in such a manner as to effectively prevent the transmission of their inherent noise to the occupied space.
C. Ballasts, contactors, starters, transformers and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.

END OF SECTION

SECTION 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 WORK INCLUDED

A. Provide all wire, cable and terminations for a complete installation.

PART 2 - PRODUCTS

2.1 PACKAGING

A. Conductors shall be delivered to the job site in approved original cartons, or on reels as recommended by the manufacturer, and shall bear the Underwriter's Label. Reels shall be provided with suitable protection to prevent fork-lift damage to conductors during shipment or storage prior to use.

2.2 SPECIALIZED CONDUCTORS

A. Conductors for specialized systems shall be as recommended by the equipment manufacturer.

2.3 CONDUCTORS - 600 VOLTS

A. Stranded copper, insulated for 600 volts. For long runs provide 90 degree rated wire as identified on drawings.

B. Insulation types THW, THHN, THWN, XHHW, RHH, RHW, or as required to suit installation conditions.

C. Thru wiring in fluorescent fixtures shall be rated for 90 degree C minimum.

2.4 CONNECTORS - 600 Volts

A. Branch circuit conductor splices: Pre-insulated "twist-on" type or "crimped-on" type as approved (Scotch-lok, Ideal or equal).

B. Cable Splices: Split-bolt or tool applied sleeves with pre-formed insulated cover, heat shrinkable tubing or approved plastic insulating tape.

C. Terminator lugs of No. 12 wire and smaller: Spade, insulated type to be tool applied.

D. Terminator lugs for No. 10 wire or larger: Two bolt (or approved positive restraint), tool applied compression type (Burndy or equal).

2.5 INSULATING MATERIALS

A. Insulating tape or heat shrink tubing shall have the equivalent rating of the applicable conductor insulation (Scotch 3M, RAYCHEM or equal).

2.6 PLASTIC CABLE TIES

A. Nylon, or equivalent, locking type (T&B or equal).

2.7 METAL CLAD CABLE

A. Metal clad cable is an acceptable wiring method instead of EMT conduit and wire for lighting and receptacle branch circuits. Metal clad cable is not acceptable from the homerun junction box back to the panel for lighting and receptacle circuits.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all wiring in raceway.

3.2 MINIMUM WIRE SIZE

Lighting and Power System ..... No. 12 AWG
Fixture Wire ..... No. 14 AWG
Wiring in Fixture Troughs ..... No. 12 AWG
Control Circuits for Motors, etc. ..... No. 14 AWG
Fire Alarm Line Voltage Wiring ..... No. 14 AWG

Low Voltage Wiring ..... As recommended by Mfgr

3.3 CONDUCTOR TYPES, REFERENCED ON PLAN

A. Conductors shall be copper.

3.4 CONDUCTOR COLORING CODE

Conductor color coding shall be as follows:

A. 208/120 volt system
   A Phase - Black
   B Phase - Red
   C Phase - Blue
   Neutral – White
   Grounding – Green
   Switched wires – Other colors
B. 480/277 volt system
   A Phase - Brown
   B Phase - Orange
   C Phase - Yellow
   Neutral – Gray
   Grounding – Green with Yellow Trace
   Switched wires – Other colors
C. Conductors shall have colored insulation except wires larger than #8 may be black with colored tape identification at all terminations and splices.
D. Additional colors may be used where such colors will help in identifying wires and different systems.

3.5 CONDUCTOR INSTALLATION

A. Raceways shall be complete, clean and free of burrs before pulling conductors.
B. U.L. approved pulling compounds may be used with the residue cleaned from the conductors and raceway entrances after the pull is made.
C. Contractor shall obtain the manufacturer's published recommendations for the handling, pulling and terminating of the cable. Contractor shall perform work in accord with manufacturer's recommendations and accept all responsibility for work not in accord with manufacturer's recommendations.
D. Pulleys or blocks shall be used for alignment of the conductors when pulling. Pulling shall be in accordance with manufacturer's specifications regarding pulling tensions, bending radius of the cable and compounds. No mechanical pulling means shall be used for wires No. 8 AWG and smaller. Cables shall be pulled by the conductor, not by the insulation or shielding.

3.6 MOISTURE PROTECTION

A. Cable ends shall be protected at all times from moisture. Provide approved heat-shrink end caps or equivalent for all unterminated cable ends.

3.7 CONDUCTORS IN PANELS AND SWITCHBOARDS

A. Conductors in panels, switchboards and terminal cabinets shall be neatly grouped and formed in a manner to "fan" into terminals with regular spacing.

3.8 CABLE SUPPORTS

A. Provide conductor support devices as required by code in vertical cable runs.

3.9 INSULATION REMOVAL

A. Insulation shall be removed with approved wire stripping tools. Conductors that are nicked or ringed are unacceptable and shall be cut off and re-stripped.

3.10 INSULATION OF ENERGIZED TERMINATIONS

A. Insulate all exposed energized connections and splices with approved tape or heat shrink tubing. Tape, if used, shall be half-lapped in two directions.

3.11 TERMINATIONS - COPPER CONDUCTORS 600 VOLTS

A. Control and special systems wires shall be terminated with a crimped on lug when terminating at a screw connection.

B. All screw and bolt type connectors shall be made up tight and retightened after an eight hour period. Tighten all bolted connections with a ratcheting type torque wrench per manufacturer's standards.

C. All tool applied crimped connectors shall be applied per manufacturer's recommendations and physically checked for tightness.

END OF SECTION

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 WORK INCLUDED

A. Provide a complete grounding system that complies with the current edition of the National Electrical Code (NEC), and all applicable regulatory codes.

PART 2 - PRODUCTS

2.1 GROUND RODS

A. Minimum size: 3/4" diameter by 10'-0" long, copper clad steel rods, or as noted on the drawings.

2.2 GROUND CONDUCTORS

A. Grounding conductors shall be soft drawn, bare, stranded copper unless otherwise noted. Size as shown on the plans and per the National Electrical Code (NEC) Article 250.

1. GROUNDING ELECTRODE CONDUCTORS FOR A.C. SYSTEMS: See NEC table 250.66
2. EQUIPMENT GROUNDING CONDUCTORS:
   See NEC table 250.122
   Equipment grounding conductors may be insulated; provide green insulation and/or approved permanent identification for conductors larger than No. 6 AWG. Equipment grounding conductors shall be provided in all feeder and branch circuit conduits.

2.3 GROUND ELECTRODE CONNECTORS

A. Connectors for grounding electrode conductor to ground rod shall be of the thermal fusion type; conductor-to- conductor connections may be either thermal fusion or approved hydraulically applied compression type.

2.4 GROUNDING BUSHINGS

A. Grounding bushings shall be matched to the ampacity of the grounding conductor and shall have approved set-screw type grounding lug connectors.

2.5 GROUNDING CONNECTORS

A. Shall meet the requirements of ground bushings, cast, set-screw or bolted type.

2.6 GROUNDING CLAMPS

A. Clamps shall be matched to the ampacity of the grounding conductor. Provide approved raceway hub where grounding conductor is shown protected by conduit or armored cable. Clamps shall be U-bolt type for connection to waterpipes.

PART 3 - EXECUTION

3.1 GROUND CONTINUITY

A. Maintain ground continuity throughout the entire electrical system.

B. Permanently connect the electrical system neutral to the water service. The system shall be grounded only at transformer secondaries and at the main distribution board. Branch panel neutrals must be isolated from additional points of grounding.

C. Provide approved grounding bushings or locknuts on all conduits terminating in panelboards, pullboxes or other enclosures to ensure continuity of conduit grounding connections.

D. Securely ground lighting fixtures.

E. Provide a separate grounding conductor in all metal or non-metallic conduits and in all flexible metallic conduit runs. Connect to the grounding system in an approved manner.

F. All plug-in receptacles shall be bonded to the box and raceway ground system.

3.2 GROUNDING CONNECTIONS

A. All grounding connections shall be carefully made to insure low system impedance. Locate grounding connections to allow future servicing and expansion.

B. Prior to making mechanical or thermal connections, all conductors shall be clean, dry and bright with the bonding surface thoroughly cleaned of any oxides, mill, scale or other foreign matter.

C. Ground conductors shall be protected from mechanical injury during construction. Provide protective coverings or rigid non-ferrous conduit.

3.3 GROUND RODS

A. Ground rods shall be driven into undisturbed soil to full depth. Provide additional rods, ionic salt solutions and the like where special low-resistant grounds are specified.

3.4 CONCEALED GROUND ELECTRODE SYSTEM

A. Concealed ground electrode systems, shall be installed, inspected, tested and certified for low resistance connections and low resistance to earth ground prior to being covered.

3.5 THROUGH-SLAB GROUND PENETRATIONS

A. Ground conductors extending through the slab shall be protected by a rigid conduit sleeve; the void portion of the sleeve shall be packed with a non-hardening type duct seal.

3.6 TESTING

A. Shall conform to Section 26 01 26.

END OF SECTION

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 WORK INCLUDED

A. Provide raceways for a complete electrical system. Include all fittings, hangers and appurtenances required for a complete installation.

B. Provide outlet and pull boxes required to enclose devices, permit pulling conductors, for wire splices and branching.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide boxes suitable for the location. Boxes shall meet NEMA Standards for various types.

2.2 CONDUITS

A. Galvanized Rigid Steel, thick wall (GRS)

B. Intermediate Metal Conduit (IMC)

C. Electrical Metallic Tubing (EMT)

D. Flexible Metal Conduit with and without polyvinyl chloride jacket

E. Non-metallic, polyvinyl chloride (PVC), schedule 40

2.3 FITTINGS

A. GRS and IMC couplings and connectors shall have threaded connections. Galvanized malleable iron or non-corrosive alloy compatible with galvanized conduit. Running thread or set screw type fittings are not permitted.

B. EMT - Couplings and connectors shall be rain tight, steel or malleable iron, utilizing a split corrugated compression ring and tightening nut or stainless steel locking disk. Set screw fittings are permitted in dry locations. Set screw fittings are not permitted in wet locations or in concrete. Zinc, pot metal, die cast fittings and indenter fittings are not acceptable.

C. Flexible Metal Conduit

1. Dry Locations: malleable iron or steel, Thomas & Betts "Squeeze" type or equal.
2. Damp or Wet Locations: Thomas & Betts "Super Liquid-Tight" with external ground lug.

D. PVC Fittings shall be solvent welded types.

E. Sealoff fittings shall be with filler fiber, poured compound and removable cover.

F. Expansion Couplings shall be O.Z. type EX with ground jumper.

2.4 INTERIOR WIRING, NEMA 1

A. Flush and concealed outlet boxes shall be galvanized stamped steel with screw ears, knock-out plugs, mounting holes, and fixture stud.

B. Surface outlet boxes shall be galvanized stamped steel same as above for use on ceilings and in accessible locations. Contractor shall provide cast iron galvanized for use on walls below 8 feet.

C. Boxes exceeding 4-11/16 inches square shall be welded steel construction with screw cover and factory painted.

D. Surface Metal Raceway boxes shall be of same manufacture to match raceway. Boxes shall accommodate standard devices and device plates.

E. Boxes for casting in concrete or mounting in masonry walls shall be galvanized steel (not aluminum or zinc die castings), specifically designed and listed for that purpose.

2.5 SPECIAL LOCATIONS

A. For indoor damp or dusty locations provide NEMA 4 boxes

B. For corrosive locations provide NEMA 4X boxes
C. For outdoor equipment where a drain is appropriate provide NEMA 3R boxes.
D. For outdoor locations requiring dust and water protection provide NEMA 4 or 4X boxes.

2.6 BELOW GRADE

A. Where exposed to earth, boxes (handholes or vaults) shall be constructed of precast concrete with size, configuration, hinged and locking cover. Structural loading shall be minimum H25 traffic rating.

PART 3 - EXECUTION

3.1 GENERAL

A. Install raceways concealed in construction of finished spaces.
B. Cut conduit ends square, ream smooth and extend maximum distance into all couplings and connectors.
C. Provide and install manufactured end caps on all conduit ends during construction to prevent the entrance of water or dirt. Tape, as a cover, is not acceptable.
D. Pull a properly sized mandrel through each conduit prior to installation of conductors or pull-lines to remove any materials trapped within the conduit run.
E. All PVC elbows shall be factory made.
F. Field made elbows are acceptable for steel conduits when made with approved bending tools. Bends that show conduit flattened or deformation are unacceptable and shall be replaced.
G. Conduits shall maintain a minimum 12" clearance from any high temperature surface.
H. The conduit layout shall be carefully planned by the contractor to ensure neat and workmanlike installation.
I. Any work showing inadequate planning may be ordered removed by the Architect/Engineer and shall be replaced in a neat and proper manner at no additional cost to the owner.

3.2 CONDUIT SIZING

A. Conduits shall be sized per code for conductors with type THW insulation, although thinner insulation types are permitted in some cases. Conduit size shall not be reduced if large size is specified on the drawing. Minimum conduit size shall be ¾” trade diameter. Conduit ½” trade diameter may be used for dead end receptacles and switch runs.

3.3 GRS AND IMC

A. Install GRS or IMC for all conduits in wet locations, concrete, underground, exposed to weather, where subject to physical damage and as noted on drawings.
B. Connections shall be watertight in damp locations.

3.4 EMT

A. EMT may be installed for wiring in masonry block, frame construction, furred ceilings, above suspended ceilings and in dry location concrete, exposed dry location unfinished spaces not subject to physical damage. EMT shall not be installed underground, under concrete slabs-on-grade, in concrete slabs-on-grade, exposed to weather, on exterior of buildings or on roofs.
B. Contractor shall coordinate assembly and installation of EMT in masonry block construction to avoid construction delays. Avoid surface cut masonry units wherever such masonry units are to remain unplastered or exposed.

3.5 FLEXIBLE CONDUIT

A. Provide flexible conduit connection to motors and equipment subject to vibration with at least a 60 degree loop to allow for isolation and flexibility. Use liquid-tight for pumps, equipment which is regularly washed down, and for equipment in damp locations. Provide bonding jumper as required by N.E.C.

3.6 PVC CONDUIT

A. PVC conduit may be used underground when permitted by code and where designated as an acceptable substitute for GRS or IMC on the drawings. Field bends, less than 45 degrees, when necessary, shall be formed with factory recommended heater. PVC bends 45 degrees or greater shall be factory made.

3.7 UNDERGROUND RACEWAYS

A. Burial depth of underground raceways shall be not less than NEC minimums and shall be deeper where so noted herein or required to avoid conflicts.
B. Arrange and slope conduits entering buildings to drain away from the point of entry.
C. Conduits passing through the exterior walls below grade and/or bridging areas of naturally unstable soil conditions or previously filled areas shall be placed in a manner to avoid crushing from ground settlement. Backfill under conduit shall be thoroughly compacted. Provide approved deflection fittings on conduits.

3.8 CONDUITS IN FOUNDATION AREA

A. Conduits in foundation areas shall be installed so as not to undermine the footings. Check structural drawings for any specific instructions. Backfill over conduits under footings and concrete slabs shall conform to the requirements of the Architect/Structural Engineer.

3.9 STUBUPS THROUGH CONCRETE SLABS OR FINISH GRADE

A. Conduits through concrete slabs shall be steel. Install at such depth that the exposed conduit is vertical and curved section of the elbow is not visible.
B. All steel conduit below grade to 6” above grade shall be wrapped with Scotch 50 Anti Corrosion Protective tape or equal.

3.10 INSERTS AND SLEEVES

A. Furnish and install all inserts and sleeves necessary for Division 26 installation prior to pouring of concrete slabs and walls.
B. In existing concrete slabs and walls utilize drilled-in threaded inserts, installed as recommended by the manufacturer, where additional supports are required. Neatly core drill openings where additional sleeves are required.

3.11 SEALING RACEWAY PENETRATIONS

A. Exterior Wall Surface Above Grade
For concrete construction above grade, cast raceway or sleeve in wall or core drill wall and hard pack with a mixture of equal parts of sand and cement. Seal around all penetrations, with caulking approved by Architect/Engineer.
B. Exterior Surface Below Grade
Cast raceway into wall/floor or use manufactured seal assembly cast in place. OZ type "FSK" or equal. Change from PVC to steel conduit (couplings or bushings) where necessary to obtain a watertight seal in poured concrete wall or floors.
C. Roof
Conduits passing through building roof shall be flashed using a 4 lb. per square foot lead plumbing vent flashing extending not less than 10" from the conduit under the roofing, and not less than 10" above the roof around the conduit. Flashing shall be attached by an approved galvanized or stainless steel clamping band.
D. Fire Rated Construction
1. All seals must meet with the approval of the local Fire Marshal.
2. Concrete or Masonry
a. Seal around raceway with an approved firestop compound that passes UL test 1479 (ASTM E814) DOW CORNING 3-6548, T & B FLAME SAFE, 3M Fire Barrier Caulk, 3M #Fire Barrier Putty, or equal.

3. Plaster or Gypsum Wallboard
    a. Seal around raceway penetration with plaster and approved fire tape.

E. Acoustical Sealing
1. Provide Acoustical Sealing of all wiring and raceway openings in ceilings, walls and floors which are critical barriers for noise transfer. Acoustical sealing shall consist of resilient caulking to seal all openings around wiring and electrical raceways.

3.12 SEALING CONDUITS

A. Seal interior of all conduits which enter the building through floor, roof or outside walls and may carry water into the building. Seal on the end inside the building, using duct sealing mastic, non-hardening compound type, specifically designed for such service. Pack around wires in the conduit.

B. For exterior wall penetrations below grade, install OZ type "CSB" sealing bushing at interior end of penetrating conduit. Threaded fittings-only are permitted in entering conduits ahead of the sealing bushing.

C. Provide for water drainage so no electrical problems will result if seals leak.

3.13 CONDUIT HANGERS

A. General
1. Provide for supporting all conduits from the building structure. Space supports per NEC. Contractor shall provide supports adequate for the loads and resistant to earthquake forces.
2. Contractor is responsible to calculate lbs/sq ft of proposed main conduit runs and verify with project structural engineer if acceptable or additional structural bracing is required. Contractor shall alter conduit route or provide additional bracing acceptable to the structural engineer.

B. With Suspended Ceiling Areas
1. Contractor may attach 1/2" and 3/4" EMT conduits to ceiling suspension systems provided such systems are structurally suitable. Attachment to suspension systems shall be made with clips specifically manufactured for this purpose. (CADDY or equal)

C. Conduits not attached to the ceiling suspension system shall be fastened with approved pipe straps or separate suspension hangers to ceiling metal inserts and/or structural members.

D. Hangers for Direct Mounted Conduits
1. Hangers attached directly to building surface shall be two hole sheet steel or one hole malleable iron, all galvanized, pipe clamps. (Thomas & Betts or approved equal).
2. Hangers for ground cable and PVC conduit supporting ground cable shall not encircle the cable or conduit in metal but shall be 2-hole plastic or 1-hole metal clamps.

E. Hangers for Single Suspended Conduit
1. Hangers suspended below ceilings shall utilize steel rods and malleable iron pipe rings sized for the application (Grinnell No. 97 or approved equal). Provide concrete hanger inserts as required.

F. Trapeze Type Suspended Supports
1. Trapeze type supports shall be used where two or more conduits use the same routing. Such hangers shall utilize steel rods, structural steel channels, and clamps of Kindorf, Unistrut or approved equal, sized for the application.

G. Support of Conduit in Steel Stud Walls
1. Attach conduits to studs with approved straps or 18 gauge steel wire secured to steel bars.

3.14 CONTINUITY OF CONDUIT SYSTEM

A. Conduits shall be assembled continuous and secured to boxes, panels, etc., with appropriate fittings to maintain electric continuity.

3.15 PULL-LINES

A. Provide 150 pound plastic pull-lines in conduit-only systems and spare conduits to facilitate future conductor installation.

3.16 ANCHORING

A. All interior boxes shall be firmly anchored directly or with concealed bracing to building studs or joints. Boxes must be so attached that they will not "rock" or "shift" when devices are operated.
B. Exterior boxes shall be fastened to approved hot dipped galvanized mounting supports and racking appropriate for size of enclosure.

3.17 FLUSH MOUNTING

A. All boxes shall have front edge (box or plaster ring) even with the finished surface of the wall or ceiling. Use of long screws with spacers or shims will not be acceptable.

3.18 RECEPTACLES AND SWITCHES

A. Coordinate the work of this Section with the work of other Sections and trades. Study all drawings that form a part of this contract and confer with the various trades involved to eliminate conflicts between the work of this Section and the work of other trades. Check and verify locations with respect to door swings, installation details, cabinet work, and suspended ceilings indicated on contract drawings. Review and coordinate locations of all plumbing, heating, and ventilating equipment and other equipment indicated on the contract drawings of all trades.
B. Centered on Built-In Work: In the case of doors and cabinets, where devices are centered between two such features, rough-in these device locations exact. Relocate any devices which are located off center at no additional cost to the owner.
C. Where more than one device is shown or specified to be at the same elevation or one above the other, align them exactly on centerlines horizontally or vertically. Relocate as directed all such devices including light switches, receptacles, voice/data, signal and thermostat devices which are not so installed, at no additional cost to Owner.
D. Device Outlet Height: Measure from the finished floor to the centerline, unless otherwise noted on electrical or architectural drawings, or required to serve specific equipment.

Switches	42 inches, set vertically
Receptacles	18 inches set vertically
Other	As shown on the plans or as directed by the Architect/Engineer

3.19 LIGHTING FIXTURES

A. Locate in accordance with approved architectural ceiling layout plans so light fixtures replace full size lay-in ceiling tiles wherever possible. Notify Architect/Engineer of any conflicts between plans prior to rough-in. Contractor shall relocate light fixtures at no additional charge if field coordination is not done prior to installation.

3.20 ELECTRICAL WORK IN COUNTERBACKS, MILLWORK AND CASEWORK

A. Provide templates, where required, to other trades for drilling and cutting to insure accurate location of electrical devices as field verified prior to rough-in with the Architect.

3.21 CONNECTION TO EQUIPMENT

A. Provide device back boxes of size and at locations necessary to serve equipment furnished under this or other Divisions of the specifications or by others. A device box is required if equipment has pigtail wires for external connection, does not have space to accommodate circuit wiring or requires wire different from circuit wiring used. Study equipment details to assure proper coordination.

3.22 BLANK COVERS

A. Provide blank cover or plate over all boxes.

3.23 JUNCTION BOXES OR PULL BOXES IN SUSPENDED CEILINGS

A. Shall be supported from structure independently from ceiling suspension system.

3.24 DEVICES BOXES CONTAINING EMERGENCY AND NORMAL DEVICES

A. Permitted only with steel barrier manufactured especially for that purpose of dividing the box into two completely separate compartments.

3.25 DEVICE BOXES CONTAINING MULTIPLE DEVICES FOR SYSTEMS RATED OVER 150 VOLTS TO GROUND

A. Permitted only with steel barrier manufactured specifically for the purpose of dividing the box into separate compartments for each device having exposed live parts.

END OF SECTION

SECTION 260534 – METAL CLAD CABLE (TYPE MC) AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 WORK INCLUDED

A. Provide Metal Clad (Type MC) Cable for power, control and lighting systems.
B. Provide wiring connections and terminations.

1.3 REGULATORY REQUIREMENTS

A. UL 1569. Products shall be tested, approved and labeled/listed by Underwriters Laboratories, Inc.

1.4 USES PERMITTED

A. MC Cable is permitted to be used for 20 amp lighting and power circuits where routing is above grade, concealed and the installation meets the requirements of NEC 330.
B. MC Cable shall NOT be used for homerun circuits from the fixture, receptacle, or equipment to the Panelboard. Hard conduit must be used from the Panelboard to the nearest accessible ceiling space above the equipment.
C. MC Cable shall not be used for HVAC equipment.

PART 2 - PRODUCTS

2.1 CABLE ASSEMBLY

A. Metal clad cable assemblies shall consist of 2, 3, or 4 current carrying conductors and equipment ground conductor.
B. Conductors: Solid Copper conductor, No. 12 AWG minimum or No. 10 AWG maximum. Installation methods shall be as specified under Part 3 – Execution.
C. Insulation: Conductor insulation shall be rated 600 volt, Type THHN, 90°C dry.
D. Fillers: Fillers shall be non-hygroscopic and non-wicking.
E. Binder: Core binder shall be corrugated polyester.
F. Sheath: The metal sheath shall be galvanized steel or aluminum. The metal sheath shall be extruded onto the cable applied longitudinally, then wrapped and welded. The sheath shall then be corrugated for greater flexibility.
G. Jacketing: When PVC jacketing is required, the jacket shall be flame –retardant PVC with a temperature range of -40°C to 90°C.
H. Equipment Grounding Conductor: The equipment ground wire shall be of the same construction as specified in 2.02 A and 2.02 B and be at a minimum the same size as the current carrying conductors. The insulation color shall be green.

2.2 FITTINGS

A. Fittings shall be UL listed and identified for such use with metal clad continuous corrugated sheath cable, with or without PVC jacketing, as is appropriate for the installation.
B. Connectors shall be of steel or malleable iron and shall be a squeeze type clamp connector with a locknut for non-jacketed metal clad cable. Compression gland type connectors shall be used for jacketed metal clad cable.

PART 3 - EXECUTION

3.1 INSTALLATION – POWER AND LIGHTING SYSTEMS WIRING

A. All wiring shall be installed in compliance with the latest version of the National Electrical Code and all other applicable codes and standards as indicated elsewhere in these specifications.

B. Use of metal clad cable shall be permitted only for lighting, equipment and receptacle branch circuits. Metal clad cable shall not be permitted in locations designated to be hazardous Class I, II, or III.
C. Metal clad cable shall be permitted only for motor circuits where the motor being served is less than ½ HP and rated for 120V, single phase. Metal clad cable is not permitted for HVAC equipment and controls.
D. Metal clad cable shall only be installed concealed within walls and above ceiling interstitial spaces. Where there is no ceiling interstitial space, metal clad cable may not be used.
E. Bends in corrugated sheath metal clad cable shall be made so that the cable will not be damaged. The radius of the curve of the inner edge of any bend shall not be less than seven (7) times the diameter of the metallic sheath.
F. Metal clad cable is not permitted to connect branch circuits to fume hoods, gas storage cabinets, or chemical storage cabinets.
G. No metal clad cable shall be installed in ventilation ducts or plenums.
H. Conductors in Enclosures: Provide neat and workmanlike installation with conductors tied with T & B Ty-Rap, Virginia Plastics, or equal, nylon wire ties in terminal cabinets, gutters and similar locations.

3.2 FITTINGS

A. Fittings used for connecting metal clad cable to boxes, light fixtures or other equipment shall be UL listed and identified for such use.
B. Cable preparation for installation of fittings shall follow manufacturer's instructions. The manufacturer's specialized tools shall be used for preparing cable ends for installation of fittings.
C. The cable end shall be cut square to ensure flush seating of the cable into the fitting. Fitting securement screws shall be properly torqued. Cable ends shall be fitted with insulating bushings intended for the type of metal clad cable being installed.
D. For jacketed metal clad cable, the outer jacket shall be removed to the length specified by the fitting manufacturer's instructions. Remove oils or solvent by-products from the outer jacket of the cable. The cable end shall be cut square to ensure flush seating of the cable into the fitting. The fitting gland nut shall be properly torque to the manufacturer's specifications.

3.3 ARRANGEMENT AND SUPPORT

A. Metal clad cables shall be run parallel with walls or structural elements. Vertical runs shall be plumb; horizontal runs level and parallel with structure, as appropriate. Groups shall be racked together neatly with both straight runs and bends parallel and uniformly spaced.
B. Metal clad cables shall be securely fastened in place at intervals of not more than six feet, suitable clamps or fasteners of approved type, and all vertical conduits shall be properly supported to present a mechanically rigid and secure installation.
C. Metal clad cable installed parallel to framing members, such as studs, joist, or rafters, shall be supported so that the nearest outside surface of the cable is not less than 1-1/4 inches from the nearest edge of the framing member. Where this distance cannot be maintained, the cable shall be protected by a steel plate, sleeve, or equivalent that is at least 1/16 – inch thick.
D. Maintain at least 6-inch clearance between metal clad cables and other piping systems. Maintain 12-inch clearance between metal clad cables and heat sources such as flues, steam pipes and heating appliances.
E. No metal clad cable shall be fastened to other conduits or pipes or installed so as to prevent

the ready removal of other pipes or ducts for repairs.

F. Individual metal clad cables hung from the roof structure or structural ceiling shall be supported by split-ring hangers and wrought–iron hanger rods. Where three (3) or more metal clad cables are suspended from the ceiling in parallel runs, use steel channels, Kindorf, Unistruct, or equal, hung from ½-inch rods to support the conduits. The conduit on these channels shall be held in place with metal clad cable clamps designed for the particular channel that is used.

G. Secure metal clad cable support racks to concrete walls and ceilings by means of cast-in-place anchors; die cast, rustproof alloy expansion shields; or cast flush anchors. Wooden plugs, plastic inserts, or gunpowder driven inserts shall not be used as a base to secure conduit supports.

H. Metal clad cable shall be supported immediately on each side of a bend and not more than one (1) foot from an enclosure where a run of metal clad cable ends.

END OF SECTION

SECTION 260800 - COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Description of the Commissioning process for this project
2. The commissioning process in this section shall be used to comply with 2018 Washington State Energy Code, C408, System Commissioning as well as C103.6, Building Documentation and Close out Submittal Requirements.
3. The certified commissioning professional (CCP) directs and coordinates commissioning activities.
4. The commissioning process, including acceptance of equipment and systems within the Scope of Commissioning, is to be completed before Final Inspection.

1.2 SCOPE OF COMMISSIONING

A. Building lighting controls installed in Division 26
   1. Interior occupancy sensors, daylight dimming sensors, and central lighting controls
   2. Exterior lighting controls

B. Photovoltaic system installed by turnkey contractor

1.3 RELATED WORK:

A. 230800 Systems Commissioning. Refer to this section for additional details regarding the commissioning process.

B. Division 26 lighting and lighting controls equipment

C. Division 26 photovoltaic equipment

1.4 SUBMITTALS

A. Division 26 shall provide submittal documentation relative to commissioning as specified in this Section and in Section 230800 for the following:
   1. Interior lighting controls
   2. Exterior lighting controls
   3. Solar photovoltaic system

B. Division 26 submittal documentation related to commissioning includes:
   1. Manufacturer's product data, cut sheets, and shop drawings.
   2. Manufacturer's installation instructions.
   3. Startup, operating, and troubleshooting procedures.
   4. Factory test reports.
   5. Instructions shipped with equipment. Provide copies as soon as the equipment is delivered.
   6. Warranty information, including details of the Owner's responsibilities in regard to keeping warranties in force

1.5 RESPONSIBILITIES

A. Include and itemize the cost of commissioning in the contract price.

B. In each purchase order or subcontract written regarding the commissioned systems, include requirements for submittal data, start-up reports, O&M data, and training requirements, as specified in this section and other Division 26 sections.

C. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.

D. Develop start-up forms using manufacturer's start-up procedures or utilize other existing standard start-up forms. For example, the startup plan for a low voltage lighting control system shall include the data required in a form or chart that will be used to document point-to-point checkout and controls system parameters such as time delays, sensitivities, daylighting setpoints, sequence of operation, (e.g. manual ON, auto OFF) and load parameters (e.g. blink warning, etc.). Startup forms for non-networked equipment may be simple signoff charts that list each piece of equipment (e.g. every room with a non-networked occupancy, vacancy, or daylight sensor).

E. Develop a start-up plan that contains a start-up form for each piece of equipment included in the commissioned systems. Where there are multiple similar pieces of equipment, the start-up plan shall provide blank forms or checklist rows for each piece of equipment. If agreed by the commissioning professional, the general contractor, and the electrical contractor, the commissioning professional may develop the start-up plan for review by the contractor.

F. Submit the start-up plan to the commissioning professional for review and approval at least 8 weeks prior to startup.

G. Provide additional requested documentation, prior to normal O&M manual submittals, to the Commissioning professional for development of functional testing procedures.

1. Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning professional.

2. The Commissioning professional may request further documentation necessary for the commissioning process.
3. This data request may be made prior to normal submittals.

H. Notify the General Contractor or Commissioning professional, depending on protocol, when the following work will be performed:
1. Start-up and checkout of Lighting Control Systems
2. Start-up and checkout of Solar Photovoltaic Generation System

I. During the startup process, execute the electrical-related portions of the startup plans for Division 22 and Division 23 equipment (e.g. full load power measurements for garage exhaust fans).

J. Complete the documents in the Start-up Plan, providing a copy to the Commissioning professional. This is called the Start-up Report. Provide copies of partially completed start-up forms to the CxP upon request to demonstrate progress.

K. Address current A/E punch list items before functional testing.

L. Review and confirm commissioning professional's functional test will not void any warranty.

M. Provide skilled technicians to perform functional testing under the direction of the Commissioning Professional. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

N. Correct deficiencies (differences between specified and observed performance) as interpreted by the Commissioning professional, construction manager, and Architect and retest the equipment.

O. Include the results of commissioning in the final as-built drawings and manuals. Ensure that the closeout documents include the following:
   1. Lighting control systems: update the original sequences of operation to as-built conditions, as determined during commissioning.

P. Coordinate with the Commissioning Professional so they may witness training of the Owner's operating staff, as specified in Division 1 training requirements and in other Division 26 sections for the following:
   1. Lighting Control Systems
   2. Solar Photovoltaic Generation System

Q. Warranty Period
   1. Execute seasonal or deferred functional testing, witnessed by the Commissioning professional, according to the specifications. In particular, coordinate with the Commissioning professional so that they may witness any needed re-calibration work.
   2. Correct deficiencies and make necessary adjustments to O&M manuals and record drawings for applicable issues identified in any deferred testing.

1.6 FUNCTIONAL TEST PREREQUISITES

A. The following applicable generic prerequisite checklist items are listed on each written functional test form and shall be confirmed and checked off by CxP prior to functional testing:
   1. All related equipment has been started up. Start-up reports are submitted and approved ready for functional testing.
   2. All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with sensor calibrations completed.
   3. Current punch list items for this equipment corrected.
   4. These functional test procedures reviewed and approved by installing contractor.
   5. Safeties and operating ranges reviewed by the CxP.
   6. Test requirements and sequences of operation attached.
   7. Schedules and setpoints attached.
   8. Sufficient access and clearance around equipment for servicing.
   9. Record of all values for pre-test setpoints to accommodate testing has been made and a check box provided to verify return to original values (control parameters, limits, delays, lockouts, schedules, etc.).
   10. Other miscellaneous checks of the prefunctional checklist and start-up reports completed successfully.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all test equipment necessary to fulfill the testing requirements of this Division.

B. For lighting control systems, provide the computer interface to the control system for the purposes of functional testing, even if that interface will not become the property of the Owner.

PART 3 - EXECUTION

3.1 STARTUP

A. The electrical contractor shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this Section. Division 26 has start-up responsibility and is required to complete systems and subsystems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning professional or Owner.

B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the Commissioning professional and General Contractor. Beginning system testing before full completion does not relieve the Contractor from fully completing the system, including the startup report.

3.2 START-UP REPORTS FOR LIGHTING CONTROLS

A. Prefunctional checklist information provided by the CCP to demonstrate that lighting controls are installed per the contract documents and are operating automatically. Start-up forms provided by the installer may be used, as approved by the CCP.

3.3 START-UP REPORTS FOR PHOTOVOLTAIC

A. The approved photovoltaic submittal shows a rated peak power (alternating current) that matches the construction documents, energy code compliance documents, and utility program application documents, as applicable.

B. Installer’s typical start-up form and field report

C. Written confirmation that the system is connected to the Internet and reporting production data

D. An account (username and password) for the CCP’s use in confirming photovoltaic system reporting

3.4 TESTING AND ADJUSTING

A. Contractor shall perform functional testing according to responsibilities listed in the commissioning plan and under the direction of the Commissioning Professional. Appropriate personnel shall be present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. The commissioning process reviews testing and adjusting work but does not perform this work. The commissioning procedures and functional testing do not relieve or lessen the responsibility of the contractor to fully test and adjust the systems and equipment covered by this section.

3.5 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the start-up plan and the start-up report, as defined in this section.

3.6 LIGHTING CONTROLS FUNCTIONAL TEST REQUIREMENTS

A. Detailed functional testing requirements will be developed by the commissioning professional and submitted to the contractor for review.

B. Parties Responsible to execute Functional Test
   1. Electrical Contractor: assist with testing, correct deficiencies.
   2. CCP: perform and document testing.
   3. Owners Representative: witness

C. Tested functions and/or modes
   1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned including manual modes and power failure. Test functionality of this system in all control strategies or interlocks that it is associated with such as receptacle controls.

D. Required Monitoring
   1. None

E. Acceptance Criteria
   1. Occupant sensors function to turn lighting within the room ON and OFF.
   2. Occupant sensors are programmed for manual ON / auto OFF with a 10-minute delay.
   3. Occupant sensors maintain motion detection for arm motion and hand motion. Test may include temporarily programing the sensor for a short delay to test sensitivity.
   4. Photocell (dimming sensors) function to lower and raise light levels within the room
   5. Lighting in rooms adjacent to the tested room are not affected by the sensors within the tested room.
   6. Tested rooms include locations that are “worst case” for wifi signal; that is, they are furthest away from wireless access points. These “worst case” rooms are tested twice to confirm a sufficient wifi signal.

F. Sampling Strategy
   1. Test 20% of rooms. Within each room, test all lighting controls.

G. Post Occupancy Testing
   1. None

3.7 PHOTOVOLTAIC FUNCTIONAL TESTING REQUIREMENTS

A. Detailed functional testing requirements will be developed by the commissioning professional and submitted to the contractor for review.

B. Parties Responsible to execute Functional Test
   1. Photovoltaic Installer: demonstrate system operation, assist with testing, correct deficiencies.
   2. CCP: perform and document testing.
   3. Owners Representative: witness

C. Tested functions and/or modes
   1. Observe installed photovoltaic system to confirm that every element is connected and operational.
   2. Review online power production reports to compare with peak rated system performance.

D. Required Monitoring
   1. None

E. Acceptance Criteria
   1. Photovoltaic system at least 95% of the rated peak power, in unit of A/C as shown on the approved product submittal.

2. The owner has been provided with an account to access the photovoltaic system's production data.

F. Sampling Strategy
1. None

G. Post Occupancy Testing
1. The online production test is likely to happen after occupancy. This test requires a sunny day with little or no clouds and a sun angle that is conducive to peak electricity production, normally occurring April through August.

END OF SECTION 260800

SECTION 260943 – WIRELESS LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. The following specification covers all system components for a complete and fully operational distributed intelligence sensor and lighting control system.

B. System commissions shall be completed by a factory trained representative.

1.3 REFERENCES

A. cULus Listing/Certification
   1. Certified as Energy Management Equipment (UL 916)
   2. Certified as Emergency Lighting Equipment (UL 924)
   3. Meet Heat and Smoke Release for Air-Handling Spaces (UL 2043)

B. Federal Communications Commission (FCC)

C. Local Building Codes

1.4 SYSTEM DESCRIPTION

A. Lighting Control System includes computer-based software that provides control, configuration, monitoring and reports. System includes the following components:
   1. ZigBee based Wireless Manager
   2. System Server
   3. 0-10V Dimming, 0-10V LED Drivers
   4. System Field Devices (ZigBee based Wireless Input & Output Modules)
   5. Sensors (Low Voltage/Wireless Occupancy & Photo sensors)
   6. Wireless Wall Stations
   7. Lighting Control System Software
   8. Interface to Audio Visual equipment (e.g. LCD Touch Screen Panel)
   9. Interface to BACnet
   10. Interface to Tridium Niagara
   11. Interface to customizable Energy dashboard
   12. Relay panel for site lighting

1.5 SUBMITTALS

A. General: Provide submittals per 1.4 (B – J) below:

B. Bill of Materials: Complete list of all parts needed to fully install selected system components.

C. Product Data: For each type of product indicated.

D. Shop and Wiring Drawings: Submit shop drawings detailing control system, as supplied, including one-line diagrams, wire counts, coverage patterns, interconnection diagrams showing field-installed wiring and physical dimensions of each item.

E. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
   1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
   2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

F. Software Operational Documentation:
   1. Software operating and upgrade manuals
   2. Program Software Backup: On portable memory storage device, compact disc, or DVD,

complete with data files.

3. Printout of software application and graphic screens, or upon request, a live demonstration of Control, Configure and Analyze functionality or a video demonstrating above stated system capabilities.

G. Installation Instructions: Manufacturer's installation instructions.

H. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

I. Warranty: Copy of applicable warranty.

J. Additional information as required on a project specific basis.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be one who is experienced in performing the work of this section, and who has specialized in installation of work similar to that required for this project.

B. Manufacturer Requirements: The manufacturer shall have a minimum of 10 years of experience manufacturing networked lighting control systems and shall provide 24/7 telephone support by qualified technicians and have local technician within 100 miles of Seattle/Tacoma area.

C. Contractor shall ensure that lighting system control devices and assemblies are fully compatible and can be integrated into a system that operates as described in the lighting control notes on drawings and as described within this specification. Any incompatibilities between devices, assemblies, and system controllers shall be resolved between the contractor and the system provider, as required to ensure proper system operation and maintainability.

D. Performance Requirements: provide all system components that have been manufactured, assembled, and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

E. Performance Testing Requirements

1. Manufacturer shall 100% test all equipment prior to shipment. Sample testing is not acceptable.

F. Code Requirements

1. System Control Unit and System Field Devices shall be cULus listed and certified.
2. All system components shall be FCC /IC compliant.
3. All system components shall be installed in compliance with National Electrical Codes and Canadian Electrical Code.
4. Building Codes: All units shall be installed in compliance with applicable, local building codes.

G. ISO Certification: System components shall be manufactured at ISO-9000 certified plants.

H. Coordination

1. Coordinate lighting control components to form an integrated interconnection of compatible components.
    a. Match components and interconnections for optimum performance of lighting control functions.
    b. Display graphics showing building areas controlled; include the status of lighting controls in each area.

1.7 PROJECT CONDITIONS

A. System Field Devices (Input/Output modules) shall meet the following Environmental Conditions:

1. Operating Temperature Range: -40 deg C (-40 deg F) to +40 deg C (104 deg F).
2. Humidity: 0% to 100% RH condensing rated for damp locations. 0% to 95% RH non-condensing rated for indoor locations.

1.8 DELIVERY, STORAGE & HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged packaging with intact identification labels.
C. Storage and Protection: Store materials away from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.9 WARRANTY

A. On-going system expansion, service and support shall be available from multiple factory certified vendors. Recommended service agreements shall be submitted at the time of bid complete with manufacturers suggested inventory and pricing for system parts and technical support labor.
B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within specified warranty period.
C. Manufacturer's Warranty: All equipment shall be warranted free of defects in materials and workmanship.
    1. Warranty Period: All system hardware components shall have full warranty (non-prorated) for at least four (4) years and all software components shall carry a warranty of one (1) year from date of installation.
    2. Owner Rights: Manufacturer's warranty is in addition to, not a limitation of, other rights the Owner may have under contract documents, or warranties of third party component manufacturers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Controls: Copper Wavelinx by Copper Lighting Solutions.
B. Low Voltage and/or ZigBee based Sensors: Wavelinx Sensors by Copper Lighting Solutions, Leviton Mfg. Co., Hubbell Building Automation, Inc., SensorSwitch, Inc., PLC Multipoint Inc., The Watt Stopper, or equivalent.
C. 0-10V Dimming and/or 0-10V LED Drivers: OSRAM Sylvania, Inc., Tridonic, Universal Lighting Technologies, Philips Lighting or equivalent.
D. Prior approved controls manufacturer Alternates
    1. The wiring methods indicated on the electrical drawings are based around the Encelium Wireless System. Prior approved manufacturer control systems have a different wiring method, ballast, occupancy sensor, and photosensor requirements than what is shown on the electrical drawings. Contractors are required to familiarize themselves with all required wiring, additional parts and pieces, necessary ballasts, required installation labor, etc. to provide for a complete installed system that meets the intent and functionality of the specified system. The contractor shall provide as part of the shop drawing submittals, complete lighting drawings including wiring, equipment, equipment locations, etc. for the prior approved manufacturer alternate systems. All costs shall be included in the bid for a complete operational system that meets the specified and design system.

2.2 SYSTEM PERFORMANCE REQUIREMENTS

This specification is intended to fully describe all of the design, engineering, programming, hardware, software, ancillary devices and associated technical services required to provide a building-wide networked lighting control system. This system is specified to perform scheduled and automated lighting control sequences.

A. The lighting control “system” shall include a fully distributed WAN/LAN network of global controller/routers, sensors, switches, relays and other ancillary devices required for a complete and operable system. The system WAN/LAN shall be commissioned by Copper Wavelinx personnel or other Copper Wavelinx certified commissioning contractors.
B. The basis of system design shall utilize non-proprietary DALI Certified Control Gear (Ballasts and/or LED Drivers), industry standard 0-10V dimming or fixed output ballasts and/or 0-10V LED drivers, occupancy sensors, daylight sensors, etc.
C. UL 924 listed devices shall have the ability to control 120V/277V/347V/480V load.
D. System software interface shall have the ability to notify communication failures to system users via system & email messages. Email messages shall be available in html and text formats.
E. On-going system expansion, service and support shall be available from multiple factory certified vendors. Recommended service agreements may be submitted at the time of bid complete with manufacturers suggested inventory and pricing for system parts and technical support labor.
F. Lighting Control Software: The system shall offer two separate levels of lighting control: (1) personal lighting control for the average building occupant to control and adjust basic lighting functions in their workspace, and (2) central lighting control for the facility lighting administrator to perform energy management, configuration maintenance, monitoring operations, and providing support to building occupants.
    a. Native central control software shall be utilized for energy reporting status and complete programming without the need for any third party hardware or software. Systems that require any third party linked software or graphics shall be unacceptable.
    b. Software shall provide information on general system settings via mouse click on a floor plan. Left clicking over a device on the graphical software interface shall show a description of the selected device/function attribute.
    3. Central Lighting Control:
        a. Shall provide an Interactive, Web-based graphical user interface (GUI) showing floor plans and lighting layouts that are native to the lighting control software. The only means required to program and operate the lighting control system shall be programmed and operated from a user interface that is based on a plan view graphical screen on the user’s computer or the lighting control system’s main computer. Shall include the navigational features listed below to allow for user’s orientation within the controlled space, geographic heading and/or landmarks:
            1. Interactive;
            2. Vector based;
            3. Zoom;
            4. Rotate;
            5. Pan;
            6. Tilt.
        b. Shall allow building operator to navigate through an entire facility both in two-dimensional and three-dimensional multi-floor view, allowing for fast and easy navigation.
            1. Three-dimensional view shall exclude walls and other structural features to avoid shadowing and cluttering of the plan view.
            2. Shall display multiple floors in single view resulting in easier system performance visualization for the entire site as well as individual zones or

spaces.

3. Shall allow system performance visualization across a portfolio of buildings via a single interface.
4. All programming, assignments of lighting loads to control strategies, lighting status and lighting energy reporting shall be native to the software and executed from this GUI. Editing shall be available from this GUI in a drag and drop format or from drop down menus without the need for any third party software. Systems that utilize or require third party linked graphics are unacceptable. The GUI shall continuously indicate the status of each connected device on the system and a warning indicator on the software if a device goes offline. Systems requiring spreadsheet editing for programming and that don't offer real time feedback are not acceptable.
5. Software settings and properties shall be selectable per individual device, room based, floor based or global building based.

c. Lighting Control Software interface shall provide current status and enable configuration of all system zones including selected individual luminaire availability, current light level, maximum light level, on/off status, occupancy status, and emergency mode (response to an emergency signal) status.

6. Shall have the ability to display various lighting system parameters such as Lighting status (ON/OFF); Lighting levels, Load shedding status, or Lighting energy consumption, Occupancy status in a colorized gradient ("weather" map) type of graphical representation.
    a. Energy Analysis data shall be exportable in CSV or image file formats.
    b. Shall allow import of native AutoCAD files.
7. Reports: Reporting feature shall be native to the lighting control software and capable of reporting the following parameters for each device and zone individually without requiring any third party hardware and software:
    a. Energy consumption broken down by energy management strategy.
    b. Energy demand broken down by energy management strategy.
    c. Occupancy data by zone.
    d. Building wide occupancy status
    e. Lighting energy consumption in a color gradient ("weather map" type) view
    f. Energy performance reports shall be printable in a printer friendly format and downloadable for use in spreadsheet applications, etc.
8. Personal Lighting Control: The Personal Control Software interface shall provide current status and enable each user with the ability to dim and brighten lights, and turn them on and off by individual luminaire or zone. The Software shall offer user configurable light scenes, which may be programmed and then selected via the Software. Personal lighting control shall be available in open/private office environments.

G. Daylight Harvesting (Light Regulation Averaging): In a photo sensor-equipped system, the Central Controller Unit shall rationalize changes to light levels when ambient (natural) light is available and shall maintain a steady light level when subjected to fluctuating ambient conditions where 0-10V dimming-ballasts and/or drivers exist. Areas equipped with fixed output ballasts and/or drivers shall energize when natural light falls below foot-candle levels specified. System shall utilize light level inputs from common and/or remote sensor locations to minimize the number of photo sensors required. The System shall operate with multiple users in harmony

and not react adversely to manual override inputs.

H. Time Clock Scheduling: The system shall be programmable for scheduling lights on or off via the Lighting Control Software interface.
   1. Programming: User friendly, Outlook style interface shall be available for programming schedules.
   2. Override: Manual adjustments via wall stations or personal control software shall temporarily override off status imposed by time clock schedule.
   3. Response to Power Failure: In the event of a power failure, the time clock shall execute schedules that would still be in progress had they begun during the power outage.
   4. Flick Warning: Prior to a scheduled lights-off event or expiry of a temporary override, the system shall provide two short light level drops as a warning to the affected occupants. Flick warning time shall have the ability to be programmed via software between 1 and 5 minutes.
   5. Option to automatically turn on or wait for an input: Using this option, a group of luminaires can be made to turn on automatically in response to a scheduled event or wait for a signal from a wall station to turn the same group of luminaires on (and stay on) for the reminder of the scheduled event.

I. Load Shed Mode: An automatic load shedding mode shall be available where, when activated through the system, the control unit will reduce its output to a programmable maximum electrical demand load. The system shall not shed more load than required and load shedding priority shall be centrally configurable by control zone or by common uses (i.e., all hallways can be treated as one load shed group), with subsequent load shed priority groupings being utilized until the required defined load has been shed, for either a defined period, or until the demand response input has been removed. Systems that simply select a “load shed scene” whereby there is no guarantee that the defined required load will actually be shed are not acceptable unless the contractor provides (where allowed) and installs additional on-site peak power generation capacity via generators that are capable of carrying at least 20% of the connected load (but in no case less than a 25KW rating).

J. Emergency Mode: There shall be a mode, when activated through the system, that will immediately adjust lights to full light output and retain that level until the mode is deactivated in the event of an emergency. This setting shall override all other inputs. The system shall interface with the building emergency monitoring system at a convenient point and not require multiple connections.

K. Addressing: All ballasts and/or drivers shall be centrally addressable, on a per luminaire or multiple luminaire/zone basis, through the Central Control Software. To simplify ongoing maintenance, the system shall not require manual recording of addresses for the purpose of commissioning or reconfiguration.

L. Programmable Task Tuning: Maximum light level programmability shall be available by individual luminaire.

M. Unoccupied State: The system shall provide two states when occupancy status is vacant as per an occupancy sensor - lights turn off or lights adjust to configurable (dimmed) light level.

N. Occupied State: The system shall be capable of creating “comfort” or “support” zones to ensure that occupants are not isolated by turning off lights in adjacent areas for occupant comfort and safety, such as a hallway path to exit the premises.

O. Overlapping Zones: System shall be capable of creating “overlapping” zones to ensure continuous lighting and safety of the occupants as they move from one lighting zone to another (for example, hallways) while minimizing the energy use.

P. Participation in Intelligent Building Framework: The system shall have the ability to be a component of Intelligent Building framework. Central Control Units and System server communication shall be based on TCP/IP over Ethernet backbone.
Q. LAN Operations: System shall be capable of operating independent of building's existing network infrastructure if desired and shall not rely on tenant supplied PCs for operation. Network infrastructure shall only be utilized for Personal Control Software.
R. Firewall Security: Firewall technology shall be utilized to separate tenants from the lighting control network.
S. Lighting Maintenance:
    1. 0-10V Dimming and/or Fixed Output Ballast/LED Driver replacements shall not require re-programming of the system or re-addressing of the said components.
    2. System software shall have the ability to notify lamp & DALI Certified Control gear failures on the bus to the system users via system & email messages. Email messages shall be available in html & text formats.
T. Re-configurability: The assignment of individual luminaire to zones shall be centrally configurable by Central Control Software such that physical rewiring will not be necessary when workspace reconfiguration or re-zoning is performed. Removal of covers, faceplates, ceiling tiles, etc. shall not be required.
U. Sensor Control Parameters: Occupancy sensor time delays shall be configurable through software. Light level sensor parameters shall be configurable through software.
V. Automatic Time Adjustment: System shall automatically adjust for leap year and daylight savings time and shall provide weekly routine and annual holiday scheduling.
W. The system software shall have the capability of providing an optional web based energy dashboard to show real time energy savings data and carbon footprint reductions.
X. Contact closure input: System shall be capable of receiving a momentary and sustained contact closure input from third party sources to control lighting zones.
Y. System shall auto-configure lighting controls for spaces that have been combined or divided temporarily by moving wall or similar systems.
Z. System shall have the capability to emulate the changing colors of the natural daylighting cycle.
AA. System shall automatically lock wall stations and/or disable sensors based on one of the following system inputs: contact closure, a time schedule or the status of a monitored space.
BB. BAS Interface: The light management system shall be capable of interfacing digitally with a building automation system via either BACnet/IP or Tridium Niagara AX interface. The lighting control system shall be capable of communicating the status of output devices (lighting loads) as well as input devices (dry contacts, switches, occupancy sensors, vacancy sensors, and photocells) to the BAS. Building Automation System, utilize data from lighting control system input devices such as occupancy sensors to determine the status (occupied/unoccupied) of the mechanical control zones and perform climate adjustments accordingly.
CC. Minimized system down time: Low voltage communication bus shall be able to self-diagnose and display communication shorts or open loops resulting in minimum system down time.
DD. System shall have the capability to communicate with wireless devices (sensors & wall stations) for the purpose of lighting control.
EE. Wireless networks shall be reliable (mesh technology), self-configuring (discovery) and self-healing. Unexpected interruptions in the network shall be automatically compensated for by re-directing communication.
FF. Wireless network shall provide high level of security via 128-bit encryption.

2.3 WALL STATIONS

The system shall utilize wireless and/or low voltage wall stations.

A. General
   1. Software configurable wall station that provides on/off switching and dimming control for up to three lighting zones/scenes per wall station or more with allowable multi-gang configurations. Status is indicated by an LED display to indicate function, scene or zone. Allows manual override of the time schedule.
   2. Manual dimming and/or switching wall station that provides local on/off and dimming control over at least three lighting zones. Allows manual dimming of light levels and override of the time schedule.
   3. Scenes in the central control software shall be synchronized with the buttons on the wall station.
   4. Wall stations shall fit in a standard Decorator style wall plate and may be ganged together as required.
   5. Addressing: All wall stations shall be individually addressable & reconfigurable via Central Control Software.
   6. Shall provide local on/off or dimming control over lighting zones
   7. Shall utilizing a standard single-gang or multi-gang form factor
   8. LEDs: All wall stations shall feature LED's to indicate light on and light off status of the corresponding zones.
   9. Color: All wall stations shall meet NEMA WD1 color specifications.
   10. Style: All wall stations shall feature Decorator styling wall plates.
   11. Lighting scenes reconfigure automatically based on scene changes from personal control software.
   12. Wireless wall stations shall at minimum meet the listed electromagnetic, mechanical, electrical and data specifications and functionalities:

B. Electrical:
   1. Power source: 120/277 VAC

C. Wireless:
   1. Range: 100 ft. for line of sight and 30 ft. for through walls
   2. Radio strength: Tx: +5.7 dBm; Rx: -96 dBm sensitivity (1% PER)
   3. Protocol: ZigBee HA, AES 128-bit encryption

D. Performance:
   1. User Interface Options
      a. Three (3) scene switching with dimming – Custom labeling available upon request
      b. Three (3) zone switching – Custom labeling available upon request
      c. One (1) zone switching – allows configuration as a vacancy sensor
   2. LEDs: LEDs on the wall stations shall illuminate only if a motion is detected in the close proximity of the wall station.

E. Mechanical:
   1. Dimensions: Shall meet NEMA WD-6 spec.
   2. Plastic material – White, other colors available upon request
   3. Mounts in standard size wall box or surface mounting

F. Reliability:
   1. Ambient temperature range: -10 deg C (+14 deg F) to 50 deg C (122 deg F)
   2. Storage temperature range: -40 deg C (-40 deg F) to 70 deg C (158 Deg F)
   3. Humidity: 5% to 95% RH non-condensing rated for indoor locations.
   4. Warranty: 4 years

G. Regulatory:
   1. Safety: UL916 listed (pending)
   2. Environmental protection: Rated for dry location; RoHS compliant
   3. Radio Interference: FCC Part 15 Class B

2.4 SYSTEM FIELD DEVICES (OUTPUT MODULES)

The system shall utilize wireless field devices.

A. General:
   1. Addressing: System Field Devices shall be individually addressable via Central Control Software.
   2. System shall automatically address individual nodes during system commissioning thus eliminating the need to pre-address devices or record serial numbers during installation.
   3. Memory: Retains all system settings in non-volatile memory.
   4. Wireless Output Modules provide a common interface to 0-10V Dimming, Fixed Output Ballasts and/or 0-10V LED Drivers. The Wireless Manager, through these modules, assigns addresses to the lighting components during commissioning and establishes two-way communication. These individually addressable modules enable each lighting component to be independently controlled and configured to best meet the needs of the facility. Wireless field devices shall at minimum meet the listed electromagnetic, mechanical, electrical and data specifications and functionalities:

B. Electrical:
   1. Input voltage: Ballast/General purpose/Tungsten: 120V – 347VAC (+/-10%)
   2. Maximum load rating: 4.5A, 300W
   3. Communication ports: One (1) port for communication with low voltage devices via NEC/CEC Class 2 communication bus that uses pre-terminated 18 AWG cable.

C. Wireless:
   1. Range: 100 ft. for line of sight and 30 ft. for through walls
   2. Radio strength: Tx: +5.7 dBm; Rx: -96 dBm sensitivity (1% PER)
   3. Protocol: ZigBee HA, AES 128-bit encryption; Mesh network

D. Performance:
   1. Control Options
      a. ON/OFF Switching
      b. Continuous dimming (0 – 10V down to 1V)

E. Mechanical:
   1. Dimensions: 3.5” L x 1.5” W x 1.5” H
   2. Dual mounting: Mounts inside a standard (4” x 4”) j-Box or to ½” knock-out
   3. Material: Plenum rated black plastic (UL2043)

F. Reliability:
   1. Ambient temperature range: -40 deg C (-40 deg F) to 40 deg C (104 deg F)
   2. Humidity: 5% to 95% RH non-condensing rated for indoor locations.
   3. Mean time between failures (MBTF): 50,000 hours.
   4. Warranty: 4 years

G. Regulatory:
   1. Safety: UL916 listed-pending
   2. Environmental protection: Rated for damp location (IP54); RoHS compliant
   3. Radio Interference: FCC Part 15 Class B

H. AIR GAP OFF – Output Module
   1. Of Definition: Air Gap Off shall refer to the physical disconnection of AC power to the

ballast or driver when “OFF” is selected either automatically or manually, thus ensuring maximum energy savings by eliminating off-state phantom power losses as well as ensuring that no potentially lethal high-voltage is present at the ballast or driver when the lights appear to be off (for life-safety reasons).

2. Provisions: Provide an air-gap off relay for each control zone in the system. Where each luminaire is to be controlled (dimmed and/or switched) independently, provide one relay per luminaire. Where multiple luminaires are to be controlled (dimmed and/or switched), provide one relay per control zone, sized to handle both the inrush current as well as the maximum connected load, at the specified voltage.
3. Alternatively, for luminaire mounted at ceiling heights of 10’ or less, contractor may supply a label on each luminaire that is visible from 5’ AFF that states “WARNING: Potentially lethal voltage/currents may be present when lights are turned OFF”. Provide a sample of label as part of submittal process. For luminaire mounted above 10’, this provision is not an option.

2.5 SENSORS

The system shall utilize wireless sensors with integrated occupancy & light level measurement capabilities.

Wireless sensors shall at minimum meet the listed electromagnetic, mechanical, electrical and data specifications and functionalities:

A. Electrical:
   1. Power source: 120/277 VAC
B. Wireless:
   1. Range: 100 ft. for line of sight and 30 ft. for through walls
   2. Radio strength: Tx: +5.7 dBm; Rx: -96 dBm sensitivity (1% PER)
   3. Protocol: ZigBee HA, AES 128-bit encryption
C. Performance:
   1. Shall interface wirelessly with the Lighting Control System
D. Occupancy sensor configuration:
   1. Shall allow timeouts configurable via system software.
      a. 15 minutes default
   2. Shall allow occupancy and vacancy sensor configurations via system software.
   3. Depending on the software configuration shall switch or dim the luminaires.
   4. Shall allow overlapping and comfort zone configurations via system software.
   5. Shall provide the following coverage:
      a. 8 ft ceiling: 360°, 320 $ft.^2$ floor or larger
      b. 9 ft ceiling: 360°, 400 $ft.^2$ floor or larger
      c. 10 ft ceiling: 360°, 480 ft^2 floor or larger
      d. 12 ft ceiling: 360°,650 $ft.^2$ floor or larger
E. Photo sensor configuration:
   1. Shall supply a wireless signal to the Lighting Management System proportional to the light measured.
   2. Shall have a Fresnel lens, with greater than 60 degree cone of response. The range shall be between 0 and 100 FC.
F. Mechanical:
   1. Dimensions: 3” diameter x 1.25” height
   2. Mounting: Options available for acoustic ceiling title, drywall, poured-in-concrete octagon, 4” x 4” electrical j-box or suspended octagon j-box.

3. Indicator light: Indicator light to signify different statuses (failure, commissioning, etc.)
4. Plastic material

G. Reliability:
1. Ambient temperature range: 0 deg C (+32 deg F) to 40 deg C (104 deg F)
2. Storage temperature range: 0 deg C (+32 deg F) to 40 deg C (104 deg F)
3. Humidity: 5% to 95% RH non-condensing rated for indoor locations.
4. Warranty: 4 years

H. Regulatory:
1. Safety: UL916 listed -pending
2. Environmental protection: Rated for dry location; RoHS compliant
3. Radio Interference: FCC Part 15 Class B

2.6 WIRELESS MANAGER

A. General: The Wireless Manager is a lighting control device that collects processes and distributes lighting control information to system field devices & wall stations using radio frequency. Each wireless manager can control large quantity of wireless devices. The wireless manager automatically detect and during commissioning addresses the compatible sensors, switches & system field devices it is connected to and establishes two-way communication. The wireless manager is the central intelligence point for the area that it controls, collecting signal information from sensors, wall stations and personal control software and determining appropriate brightness levels or on/off status for each luminaire or zone. Each wireless manager has an Ethernet port for communication with the server.
1. Shall interconnect with other wireless interface modules and System Server using standard Ethernet connection that employs TCP/IP protocol.
2. Addressing: System shall automatically address compatible wireless sensors, wall stations & system field devices during system commissioning thus eliminating the need to pre-address the devices or record serial numbers during installation.
3. Wireless Interface modules shall at minimum meet the general, mechanical and environmental specifications per (B – F) below:

B. Electrical:
1. Input voltage: Via Power over Ethernet
2. Communication ports: One (1) Ethernet port (same port for powering the device/communication)

C. Wireless:
1. Range: 100 ft. for line of sight and 30 ft. for through walls
2. Radio strength: Tx: +5.7 dBm; Rx: -96 dBm sensitivity (1% PER)
3. Protocol: ZigBee HA, AES 128-bit encryption

D. Mechanical:
1. Dimensions: 3” diameter & 1.25” height
2. Plastic material
3. Mounting: Via j-box

E. Visualization & Performance:
1. Manages large number of nodes
2. Shall appear in system software
3. Shall be configured via system software

F. Reliability:
1. Ambient temperature range: 0 deg C (32 deg F) to 40 deg C (104 deg F)
2. Humidity: 5% to 95% RH non-condensing rated for indoor locations.

3. Warranty: 4 years

G. Regulatory:
1. Safety: UL916 listed-pending
2. Environmental protection: Rated for dry location; RoHS compliant
3. Radio Interference: FCC Part 15 Class B

2.7 SYSTEM SERVER

A. General: System Server shall host the lighting control system database for all the lighting control devices. In addition, it shall provide remote accessing capability to change system settings and/or parameters. Server shall have the ability to:
1. Analyze system performance or energy data or generate system report;
2. Record energy consumption with average sampling every 5 minutes for unlimited duration;
3. Host the web interface required for the web enabled Personal Control Software or web based Central Control Software;
4. Windows Server 2008 or Windows 10;
5. Reside on a client server (virtual server) thus eliminating the need for dedicated physical hardware if desired;
6. Interconnect with CUs over standard Ethernet connection that employs TCP/IP protocol; Hardware based servers shall at minimum meet the specifications listed below:

B. Electrical:
1. Power Supply: 120 VAC/60 Hz/300W; Emergency circuit preferred; Non-emergency circuit acceptable.
2. Communication ports: Two (2) Ethernet ports

C. Data Specifications:
1. Each System Server shall have two Ethernet 10/100Base - Tx Cat 6 RJ45 ports that employ TCP/IP protocol.

D. Mechanical:
1. Dimensions: 1.69" H X 17.64" W X 27.56" D (42.93mm H X 448.06mm W X 700.02mm D)
2. Shall mount in a standard 19” rack (1U width), or alternatively where no rack is shown, via an individual wall mount.

E. Regulatory:
1. FCC (US only) Class A.
2. DOC (Canada) Class A.
3. UL 60950.
4. CAN/CSA-C22.2 No. 60950.

2.8 COMMUNICATION WIRE

A. Wiring: 18 AWG, pre-fabricated, polarity independent quick connecting wiring. The system shall have the capability to use both NEC/CEC Class 1 and Class 2 wiring. The maximum connected length of wiring shall be 2500 ft. per channel.

B. Field Bus: Integrates peripheral devices such as low voltage occupancy sensors, photo sensors and wall controls into a complete, networked programmable lighting control system. Provides power to low voltage photo sensors, PIR and dual-technology occupancy sensors. Devices may be connected randomly on the network and special termination of each network channel is not required. Minimize system down time by self-diagnosing the field bus for any shorts and open loops.

C. Field bus shall at minimum meet the specifications listed below:
1. Specifications:

a. Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG.
b. Pre-fabricated 1 ft., 5 ft., 10 ft., 15 ft., 20 ft., 25 ft. and 50 ft. lengths.
c. Daisy chain topology
d. Pre-fabricated with 2-wire connectors.
e. Flame rated jacket for plenum use NFPA 262 (UL: FT6, CSA: CMP).
f. Power Supply: 12 VDC (up to 24 VDC) to sensors.

2.9 LIGHTING CONTROL SYSTEM SOFTWARE

A. Personal Control Software: Enables individuals in a building to control lighting levels in their workspace from their own desktop PC. User can control the light level of each luminaire in their workspace or can control all of the luminaire together as a group. Preset lighting scenes may be stored, recalled and modified. This software shall have the capability of acting as a "virtual occupancy sensor" for the system by detecting keyboard or mouse activity on each PC for incremental occupancy status data.
   1. Technical Information:
      a. TCP/IP network traffic < 2kb/s.

B. Web based Personal Control Software: This feature allows individuals to control lighting levels in their workspace without the requirement for installation of software on client PCs. Individuals can access the interface through the web browser and perform individual luminaire dimming control, on/off switching, modify and save preset lighting scenes.

C. Technical Information: Adobe Flash ® based user interface.
   1. System Requirements:
      a. Internet web browser with Flash® Player 8 or later.
      b. Internet/Intranet connection.
      c. SSU enabled and configured to host dynamic website.
      d. Network connection with access to a network-enabled CU.

D. Web based Central Control Software: Central control software application is used to commission, configure and manage the system. Every system parameter in a building (or campus of buildings) is configured for each individual user or space and baseline settings are established for each of the following (depending on the basis of design) system features:
   1. Daylight harvesting.
   2. Occupancy control.
   3. Smart time scheduling.
   4. Task tuning.
   5. Personal control.
   6. Load shedding.

E. Software utilizes a web based interface that permits a user to easily navigate between zones, floors or different buildings and allows a user to zoom in or zoom out of specific areas of a building. Both 3-dimensional and two-dimensional multi-floor views shall be available. System features such as creation of zone hierarchies, overlapping and support zone definitions, user access rights, timeout settings for occupancy sensors, calibration of light levels for daylight harvesting and the configuration of multiple time schedule profiles shall be available. A web based Graphical User Interface (GUI) application integral to the system will be used to develop a dynamic, real-time, point-and-click graphic of each floor plan with representation of all light luminaire, wall stations, sensors, switches, etc. A central system server will be provided to support system data base and enterprise control management.
   1. System Requirements:

a. Software must be able to run on a Windows Operating systems (Windows 10 or newer) and also on Apple Mac Intel PCs.
b. Must support all common browsers, i.e.,
    - Internet Explorer
    - Mozilla Firefox
    - Safari
    - Google Chrome
c. Must provide network connection/access to all network-enabled CUs.
d. Color gradient ("weather map" type) data view (see below for an example) must be available to display the following criteria:
    - Current energy consumption
    - Current energy savings
    - Current luminaire brightness
    - Current luminaire status
    - Current occupancy data
    - Current load shedding status
    - Other custom modes that may be specified elsewhere

2.10 AUDIO-VISUAL INTERFACE

A. General: Through this interface users can command (e.g. LCD Touch Screen Panel) various lighting scenarios depending on the audio & visual requirements of the room or building.
    1. The lighting control system shall interface to the AV system via TCP/IP protocol using Telnet.
    2. The lighting control system shall allow a common AV processor to individually control multiple rooms from a single TCP/IP port through unique room, zone, and scene addresses for lighting in each room.

2.11 BAS INTERFACE

A. General: Two separate software interfaces (BACnet/IP or Tridium Niagara AX) shall be available for integration with Building Automation System. The lighting control system, via these interfaces, communicate the status of output devices (lighting loads) as well as input devices (dry contacts, switches, occupancy sensors, vacancy sensors, and photocells) over to the building automation system. Building Automation System, utilize data from lighting control system to switch/dim lighting, perform load shedding of lighting load, to turn lights on in response to emergency signal through fire alarm and perform HVAC adjustments.
    1. The Lighting Control System shall be able to share the following information with BAS clients:
        a. Light Zone State: State of the defined lighting zone – ON or OFF
        b. Light Zone Dimming: Light output level of the defined lighting zone, from 100% (maximum light output) to 0% (minimum light output)
        c. Fire Alarm State: State of the fire alarm system – alarm activated or alarm not activated
        d. Occupancy State: State of the defined occupancy sensor – occupancy detected or not detected
        e. Photo Sensor Daylight Readings (available via BACnet interface only): Reports daylight readings by photo sensors
        f. Sheddable Load: Reports the total lighting load available for load reduction according to the Light Management System, defined in watts

g. Shed Status: Reports the total current load reduction achieved according to Light Management System defined prioritization, defined in watts
h. Shed Request: Requested total amount of load reduction, defined in watts or as a percentage of sheddable load
i. Sheddable Load (Group): (As above, for the selected group)
j. Shed Status (Group): (As above, for the selected group)
k. Shed Request (Group): (As above, for the selected group)
l. Floor plans (available via Tridium Niagara AX only): Importing lighting control software floor plans into Tridium Niagara AX framework for viewing current status and changing the proxy values.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification: Verify that wiring conditions, which have been previously installed under other sections or at a previous time, are acceptable for product installation in accordance with manufacturer's instructions.
B. Inspection: Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

3.2 INSTALLATION

A. The Electrical Contractor, as part of the work of this section, shall coordinate, receive, mount, connect, and place into operation all equipment. The Electrical Contractor shall furnish all conduit, wire, connectors, hardware, and other incidental items necessary for properly functioning lighting control as described herein and shown on the plans. The Electrical Contractor shall maintain performance criteria stated by manufacturer without defects, damage, or failure.
B. Power: The contractor shall test that all branch load circuits are operational before connecting loads to sensor system load terminals, and then de-energize all circuits before installation.
C. Related Product Installation: Refer to other sections listed in Related Sections for related products' installation.

3.3 SENSOR INSTALLATION

A. Adjust sensitivity to cover area installed.
B. Set time delay on occupancy sensors that are connect to the lighting control system to the minimum. Time delays shall be controlled via Central Control Software.
C. Low voltage sensor shall be powered through Input Module. No external power packs shall be used for powering sensors.
D. Install occupancy sensors on vibration free stable surface.
E. Install atrium and skylight light sensor facing toward window or skylight.
F. Install interior light sensor in ceiling facing the floor.

3.4 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.
B. Wiring within Enclosures: Comply with NEC & CEC. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 SOFTWARE INSTALLATION

A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current site licenses for software.

3.6 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
B. Perform the following field tests and inspections with the assistance of a factory-authorized service representative:
   1. Operational Test: After installing wall stations and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
C. Lighting control devices will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.

3.7 COMMISSIONING REQUIREMENTS & SUPPORT SERVICES

A. Commissioning: The manufacturer shall supply factory trained representatives to commission the lighting control system. Manufacturer shall start up all lighting control equipment and verify that it meets the requirements of this specification.
B. Training: As part of the standard commissioning process, the manufacturer shall train the owner’s representatives in the operation of the system to a maximum of 4 hours per building. Manufacturer shall also provide owner’s representatives with system operating manuals.
C. Technical Support: The manufacturer shall supply 24/7 technical telephone support to the client.
D. Extended Service Coverage: Maintenance agreements shall be available from the manufacturer to provide service for the system both during and after the warranty period.
E. Requests for commissioning shall be at least two weeks prior to date desired for commissioning.
F. Electrical contractor shall perform functional testing under the guidance of commissioning agent and in accordance with factory specified guidelines.
G. Factory appointed personnel shall provide commissioning services for the lighting control system.
   1. Verify proper communication over control wires.
   2. Map addresses fixed output and 0-10V ballasts/LED drivers, low voltage wall stations, low voltage sensors, wireless sensors and wireless wall stations to Wireless Manager and System Server.
   3. Verify communication to control units and system server.
   4. Configure occupancy sensors, light level sensors, wall stations and other contacts to suit design specifications.
   5. Configure and program lighting control sequences as described on contract documents.
   6. Demonstrate to Owner and Engineer proper operation of all areas the system is installed.

3.8 TESTING

A. Upon completion of all line, load and interconnection wiring, and after all luminaire are installed and lamped, a qualified factory representative shall completely configure and test the system.
B. At the time of checkout and testing, the owner’s representative shall be thoroughly instructed in the proper operation of the system.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel and building supervisors to adjust, operate, utilize, troubleshoot, conduct software installation,

and maintain lighting controls and software training for PC-based control systems. Provide up to 4 hours of on-site training. Provide a hard copy of manuals and instructional videos on CD or DVD.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 WORK INCLUDED

A. Provide all panelboard equipment complete. All equipment shall be dead front type construction and shall bear the U.L. label. Load centers will not be acceptable.

B. All panels provided for service entrance locations as defined by the NEC shall be provided with a UL label as Suitable for Use as Service Entrance Equipment (SUSE).

1.3 SHOP DRAWINGS

A. Prepare and submit for review prior to manufacture. Include front view, dimensions, device sizes and layout, list of nameplates and all other information required to demonstrate conformance with contract documents.

B. Dimensions of panelboards shall not exceed those noted on or scaled from the contract documents. Conform to 262413, Switchboard Dimensions, when dimensions exceed those allowed by contract documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Siemens

B. General Electric

C. Square D

D. Cutler Hammer

2.2 PANELBOARD DESCRIPTION

A. Voltage, arrangement, and capacity of bus and overcurrent protective devices shall be as shown on the drawings. Bus shall extend behind all spaces ready for future overcurrent protective devices.

B. Buss bars copper with ampere density not-to-exceed 1200/1000 amperes per square inch. Bussing will generally be 3 phase, 4 wire, 100 percent neutral, 200 percent for lighting and computer equipment panels, braced to match the interrupting rating of the breakers.

C. Provide multiple lugs where parallel or "feed-through" connections are shown on drawings.

D. Provide separate neutral and ground buses at the bottom of each panelboard.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Provide thermal-magnetic type circuit breakers.

B. The AIC rating of the panel shall be as specified on the drawings.

C. Mount breakers in all panelboards so that breaker handles operate in a horizontal plane. Provide common trip on all multiple pole breakers.

D. 120/208 volt circuit breakers shall be the bolt-on type.

E. Circuit Breakers rated 15A through 30A shall be U.L. rated for 60/75 degree centigrade wire. Breakers 35A and larger shall be rated for 75 degree centigrade.

F. Circuit breakers intended for switching 120 volt loads shall be switching duty rated (SWD).

G. Provide "Spare" overcurrent devices, where noted on the drawings, complete and ready for future circuit connections.

H. Provide "Space" for future overcurrent devices, where noted on the drawings. Space shall include all bussing and device mounting hardware. Provide approved coverplates or overcurrent devices in all spaces. Open spaces in the panel are not permitted.

2.4 ENCLOSURE GENERAL CONSTRUCTION

A. Provide cabinets of sufficient dimensions to allow future expansion and addition of overcurrent devices within the panelboards. All panelboards shall be provided with door-in-door construction. Provide increased enclosure width required for installation of conduits.
B. Provide factory primer coat for cabinets located in finished areas. Where cabinets are located in unfinished areas, standard lacquer or enamel finish, gray or blue-gray color, shall be substituted for factory primer coat.
C. All electrical distribution equipment locks shall be keyed identically.
D. Fasten panelboard front with machine screws with oval counter-sunk heads, finish hardware quality, with escutcheons or approved trim clamps. Clamps accessible only when dead front door is open are acceptable.
E. Surface mounted panelboards with fronts greater than 48 inches vertical dimension shall be hinged at right side in addition to hinged door over dead front. Provide three point latching mechanism with one T-handle operator.
F. Provide matching trim of same height for adjacent panels or control devices in finished areas.
G. Special remote control switches, contactors, current transformers, transducers or TVSS equipment where shown integral to a panelboard, shall be mounted on the same frame as the panelboard interior. Provide screw retained access door in the dead front shield. A common enclosure door shall cover both special integral device(s) and panelboard overcurrent protective devices.
H. Integral mounted transient Voltage Surge Suppression (TVSS) equipment. Equipment provided by the panelboard manufacturer shall have equal or better characteristics as identified in section 264313.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Secure panelboards in place with top of cabinet at 6'-0", above finished grade unless otherwise noted. Top of cabinet and trim shall be level; trim and door shall fit neatly without gaps, openings or distortion.
B. Top edges of adjacent panels shall be even.
C. Securely anchor panelboards to structural framing or walls with approved fasteners and concealed bracing as required. Provide steel channel support framing where panelboard is free standing. Submit support rack shop drawings for approval prior to fabrication.
D. Install panelboard interiors only after building structure is completely enclosed.

3.2 CIRCUIT INDEX

A. Each panelboard shall be provided with a typewritten index listing each circuit in the panel by number, with its proper designation. Listing shall match circuit breaker arrangements, typically with odd numbers on the left and even numbers on the right. Room numbers shall be the final room numbers used in the building as verified with the Owner. Mount index with a transparent protective cover inside the cabinet door.

3.3 PANELBOARD NAMEPLATE

A. Provide phenolic engraved nameplate for each panelboard. See Section 26 0500

3.4 LABELING

A. Panelboards shall be provided with required Arc Flash and Personal Protective Equipment (PPE) labels

3.5 SPACE

A. Verify space available with equipment sizes and code required working clearances prior to submittal of shop drawings.

3.6 ARC FLASH LABELING, SHORT CIRCUIT AND PROTECTIVE DEVICE COORDINATION

A. Provide per Section 260126.

END OF SECTION

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 WORK INCLUDED

A. Provide all wiring devices and plates for a complete installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hubbell
B. Arrow Hart
C. Leviton
D. Pass & Seymour

2.2 MATERIALS

A. Wiring devices shall be specification grade, and the product of a nationally recognized manufacturer regularly engaged in their production.
B. All wiring devices specified in this section shall be the product of one manufacturer. Each type shall have identical appearance and characteristics.

2.3 DEVICE COLOR

A. Switch handles and receptacles: White
B. Red for Emergency Systems.
C. Paint or other surface finish treatments are not acceptable. Verify actual colors with project Architect for special installation conditions.

2.4 SWITCHES

A. Switches shall be 20 ampere, 277 volt, quiet type with plastic handle. Single pole, double pole, 3-way, 4-way or locking type as required. Provide matching styles and color in other devices as required for the conditions of installation.
B. Momentary Contact line voltage switch: Single pole, double throw, 3 wire, normally open. Rating same as above.

2.5 RECEPTACLES

A. Duplex NEMA 5-20R configuration (20 amp, 125V)
B. GFCI Receptacles
   1. Interior: 20A-125V duplex receptacle with trip indicator light.
   2. Exterior: 20A-125V duplex, weather resistant, GFCI receptacle with trip indicator light and single NEMA 3R “In Use” metal cover, mounted horizontally.

2.6 DEVICE PLATES

A. Non-metallic with color to match device. Provide pressed steel plates for surface devices in equipment and storage areas.
B. Identification
   Provide engraved device plates with amperage and voltage for all receptacles above 125V, 20 ampere rating.

PART 3 - EXECUTION

3.1 MOUNTING

A. Rigidly fasten each device to the box at proper position with the wall to bring device flush with plate or switch handle the proper distance through the plate.

3.2 ORIENTATION

A. Set switches vertical with handle operating vertically, up position "ON" and +42" above finished

floor.

B. Set interior receptacles vertical with ground slot up; +18" above finished floor.
C. Set interior receptacles above counters, horizontal, centered in backsplash or as directed by Architect. Verify prior to rough-in.
D. Set exterior receptacles horizontal at +18" above finished grade.
E. Devices and finish plates shall be installed plumb with building lines.

3.3 RECEPTACLE GROUNDING

A. Provide bare bonding wire between receptacle grounding terminal and box. Plaster ear screws connecting the receptacle frame to the box will not be acceptable for grounding.

3.4 HANDICAPPED ACCESS

A. Comply with requirements of Washington State handicapped access code.

3.5 TRIM OUT

A. Provide device plate for each wiring device. Trim plates and devices shall not be installed until final painting is completed. Scratched or splattered plates and devices will not be acceptable.

3.6 RECEPTACLE TESTS

A. Receptacles shall be checked to ensure proper line to neutral, line to ground and neutral to ground voltages.

END OF SECTION

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 WORK INCLUDED

A. Provide fusing and appurtenances for all fusible equipment provided under this contract.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE FUSES

A. The low voltage fuse range is considered to extend over the range 600 volts or less. Fuses in this category shall be current limiting types, UL Class R, unless specified otherwise. Provide rejection style fuse clips for all current limiting applications.

B. Fuses shall be as follows or equal:

APPLICATION	AMPERE RANGE	UL CLASS	GOULD - SHAWMUT	BUSS
Motor & Branch Circuit	1-100	RK 5 Time Delay	Tri-onic	Fusetron
Feeder	60-100	RK 5 Fast	Falt-Trap	Fusetron
All	125-200	RK 1 Time Delay	Amp-Trap 2	Low Peak
Motor Circuit	225-600	RK 1 Time Delay	Amp-Trap 2	Low Peak

2.2 SPARE FUSES

A. Provide 10 % of each rating with a minimum of 3 per rating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in all fusible devices provided under this contract.

END OF SECTION

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 WORK INCLUDED

A. Provide all disconnect switches and enclosed circuit breakers required by NEC for equipment furnished under this and other divisions of these specifications and by the Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Siemens
B. General Electric
C. Square D
D. Cutler Hammer

2.2 DISCONNECT SWITCHES

A. Switches shall be NEMA type HD (heavy duty), quick make, quick break, dual rated with electrical characteristics as required by the system voltage and the load served. Switches shall be single throw and have blades to open all ungrounded conductors.
B. Enclosure shall have interlocking cover to prevent opening door when switch is closed. Interlock shall include a defeating scheme for authorized service work.
C. Operator handle shall be lockable in the "off" position.
D. Disconnect enclosures shall be suitable for mounting locations. Provide NEMA 1 for dry locations, NEMA 3R for damp or exterior locations. Provide other NEMA ratings to suit area requirements.
E. All disconnect switches shall be the product of one manufacturer to facilitate future maintenance.

2.3 FUSIBLE DISCONNECTS

A. Fusible disconnect switches provided shall be per 2.2 above with the addition of fuse space and clips to accept only Class R fuses.

2.4 TOGGLE SWITCHES

A. Motor rated toggle type disconnect switches are acceptable for fractional horsepower equipment. Switches shall be suitable for the intended load and provided with handle guard/lock-off feature (similar to Square D Class 2510).

2.5 ENCLOSED CIRCUIT BREAKERS

A. Circuit breaker operator handle shall be lockable in the "off" position.
B. Circuit breaker enclosures shall be suitable for mounting locations. Provide NEMA 1 for dry locations, NEMA 3R for damp or exterior locations. Provide other NEMA ratings to suit area requirements.
C. All circuit breakers shall be the product of one manufacturer to facilitate future maintenance.

2.6 NAMEPLATES

A. Provide nameplates on all disconnects and fused switches. Nameplates shall be engraved laminated phenolic mounted with screws. Adhesive only will not be acceptable. Each nameplate shall include this information: Load served, voltage, phase, panel, circuit number, fuse size and type.

PART 3 - EXECUTION

3.1 DISCONNECT LOCATIONS

A. Install disconnects and enclosed circuit breakers in the same relative location as the equipment

being served unless that location is difficult to access or is in an unsuitable environment. Discrete disconnect switches of similar size may be grouped in a central location.

3.2 SUPPORT

A. Secure disconnect switches and enclosed circuit breakers to building structure, equipment unit or approved mounting frame. Support by conduit system only is not acceptable.

3.3 SPLICES

A. Wiring space within disconnect switches and enclosed circuit breakers shall not be used for splicing; provide suitable wire gutters or junction boxes for this purpose.

END OF SECTION

SECTION 263100 - PHOTOVOLTAIC ENERGY EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections and Section 260500 apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. PV modules (laminates in mounting frames).
   2. Inverters.
   3. Roof mounting racking structures.
   4. Ethernet based remote monitoring of inverter and module level operation via the internet with Wi-Fi/cellular interface option.
   5. BOS: Conduits, conductors, disconnect switches, overcurrent devices and all other accessories needed for proper operation of the system.

1.3 INSTALLATION SCOPE

A. Contractor shall provide structural engineering and electrical design for a Net Metered Solar PV system interconnected to the local utility.
B. Design per Puget Sound Energy Net Metering requirements.

1.4 APPLICABLE PUBLICATIONS

A. UL 1703 and 1741
B. E927, E1038, E1171, E1462, E1802
C. IEEE 928, 929, 80, P1262, P1373, P1374
D. National Electric Code, NEC 2020
   1. 690 Solar PV Systems
   2. 705 Interconnected Electric Power Production Sources

1.5 INSTALLER QUALIFICATIONS

A. PV installer shall have a NABCEP certified installer on staff.
B. Installer shall have a minimum of 5 grid-interactive projects of minimum 30 kilowatts within 200 miles of the project site.
C. It is the intension of these specifications to furnish and install a system from a contractor regularly engaged in the design and installation of Solar PV systems.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include Data sheets for solar modules, racking system, inverter(s), web-based monitoring “dashboard”.
   2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for PV panels.
   3. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
B. Shop Drawings: For PV array.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Detail fabrication and assembly.
4. Include diagrams for AC and DC power, signal, and control wiring.
5. Include structural drawings stamped by a State of Washington licensed Structural Engineer.

C. Submit Net Metering application to utility including all required supporting documentation and fees.
D. Submit and pay for all permits required by AHJ.

1.7 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.
B. Sample Warranty: For manufacturer's special materials and workmanship warranty and minimum power output warranty.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For PV modules, inverter(s) and monitoring system to include in operation and maintenance manuals.

1.9 WARRANTY

A. Warranty of materials and workmanship as required by section 26 05 00, Common Work Results for Electrical Systems and Division 01, General Requirements.
B. In addition provide:
1. Provide minimum 25 year warranty on power output of PV modules.
2. Provide GII (Inverter) with minimum 10 year replacement warranty from the manufacturer covering parts and labor.
3. Provide minimum 2 year warranty covering parts and labor of the Solar PV System.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following Solar Module manufacturers:

Solar Modules: 450W STC Minimum.

1. Hanwha Q Cells America, Inc.
2. Kyocera International, Inc.
3. REC Solar US LLC.
4. SunPower Corporation.
5. Silfab Solar.
6. Heliene.
7. Mission Solar.

Inverters:

1. Solaredge.
2. SMA.
3. Chint Power Systems, America.

2.2 PERFORMANCE REQUIREMENTS

A. NRTL (Nationally Recognized Testing Laboratory) Listing: Entire solar module assembly shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for electrical and fire safety, Class A, according to UL 1703.

2.3 SYSTEM DESCRIPTION

A. PV System:
1. Connected via breaker in main distribution panel.

2. Modules and KW capacity as shown on drawings.
3. System Components:
    a. PV modules.
    b. Array frame.
    c. Inverter.
    d. Overcurrent protection/combiner box.
    e. Mounting structure.

2.4 MANUFACTURED UNITS

A. Module Construction:
    1. Nominal Size: 39 inches (990 mm) wide by 77.5 inches (1970 mm) long.
    2. Weight: 50.6 lb (23 kg).
B. Bypass Diode Protection: Internal.
C. Junction Box:
    1. Size: 1.56 by 3.96 by 0.52 inch (39.6 by 100.6 by 13.2 mm).
    2. Fully potted, vandal resistant.
    3. IP Code: IP65.
    4. Flammability Test: UL 1703.
D. Output Cabling:
    1. 47.25 inch, (1200 mm) Long
    2. Quick, multiconnect, polarized connectors.
    3. Two-Conductor Harness: No traditional return wire is needed from the end of a row back to the source combiner.

2.5 CAPACITIES AND CHARACTERISTICS

A. Minimum Module Electrical Characteristics: Basis of design – Sun Power A-Series Panel – 450W.
    1. Rated Open Circuit Voltage (Voc): 51.9 V dc.
    2. Maximum System Voltage: 1500 V dc.
    3. Maximum Power at Voltage (Vpm): 44.0 V dc.
    4. Short-Circuit Temperature Coefficient: 0.03%/deg C.
    5. Rated Short-Circuit Current (Isc): 11.00 A.
    6. Rated Operation Current (Imp): 10.201 A.
    7. Maximum Power at STC (Pmax): 450 W.
B. Additional Electrical Characteristics:
    1. Tolerance of Pmax: -0/+5 Watts.
    2. Minimum Peak Power: 450W.
    3. Module Efficiency: 22.2%
    4. Temperature Cycling Range: -40°C to +85°C
    5. Maximum surface load: 3500Pa upward / 6000 Pa downward
C. Normal Operating Temperature Characteristics (NOTC):
    1. Temperature at Nominal Operating Cell Temperature: 43° C.
    2. Temperature Coefficient (NOTC Pmax): -0.38 %/deg C
    3. Temperature Coefficient (NOTC Voc): -0.30 %/deg C
    4. Temperature Coefficient (NOTC Isc): 0.03 %/deg C

2.6 MODULE FRAMING

A. PV laminates mounted in anodized extruded-aluminum frames.
    1. Entire assembly UL listed for electrical and fire safety according to UL 1703, complying with IEC 61215.

2. Frame strength exceeding requirements of certifying agencies in subparagraph above.

2.7 ARRAY CONSTRUCTION

A. Framing:
1. Material: Extruded Aluminum or Galvanized steel.
2. Maximum System Weight: See structural design notes.
3. Raceways, Junction boxes and Cover Plates: Aluminum or Galvanized steel.

B. Roof Mounting:
1. Minimum 10 degree dual tilt.
2. Wind-tunnel tested to 110-mph (160-km/h) wind.
3. Service Life: 25 years.
4. System shall be Panel Claw Inc. or approved equal.

2.8 INVERTER

A. Inverter Electrical Characteristics: Basic of design – Solaredge, Model #SE80KUS
1. Maximum Recommended PV Input Power: 45 KW.
2. Maximum Voc: 1000 V dc.
3. Maximum Input Current: 97 A.
4. CEC Rated Power: 80.0 kilowatts.
5. Nominal Output Voltage: 480 V ac.
6. Maximum Output Current: 96.5 A.
7. CEC Weighted Efficiency: 98.5%.
8. CEC Night Tare Loss: < 12 W.
9. NEC 2020 Rapid Shutdown Compliant.

B. Operating Conditions:
1. Operating Ambient Temperatures: Minus 13 to plus 140 deg F (minus -25 to plus 60 deg C).
2. Relative Humidity: 0 to 95 percent, noncondensing.

C. Enclosure:
1. Type NEMA 3R.
2. Cooling Methods:
a. Fan convection cooling.
b. Passive cooling.
3. Protective Functions:
a. AC over/under voltage.
b. AC over/under frequency.
c. Ground over current.
d. Overtemperature.
e. AC and dc overcurrent.
f. DC over voltage.
4. Weight: Primary Unit 70.4 lb (32 kg); Secondary Unit 39.6 lb. (18 kg.)
5. Dimensions: 22 by 12.9 by 10.75 inches (558 x 328 x 273 mm).

D. Disconnects:
1. Low-voltage disconnect.
2. Low-voltage reconnect.
3. High-temperature disconnect.
4. High-temperature reconnect.

E. DC to DC Optimizers:

1. NEC 2017 Rapid Shutdown Compliant.
2. MPPT operating range, 12.5-60 VDC.
3. Rated input DC Power, 860W.
4. Maximum output current, 18A DC.
5. Maximum output voltage, 85V DC.

F. Web monitoring:
1. Provide inverter manufacturer web-based monitoring portal with cellular modem.
2. Website to provide daily, weekly, monthly and yearly performance data.

G. Regulatory Approvals:
1. IEEE 1547
2. UL 1741, UL 1741 SA, UL 1699B, UL 1998

2.9 MOUNTING STRUCTURES

A. Roof dual tilt mounting structure.
B. Racking listed UL2703.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Do not begin installation until mounting surfaces have been properly prepared.
C. If preparation of mounting surfaces is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
D. Examine modules and array frame before installation. Reject modules and arrays that are wet, moisture damaged, or mold damaged.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
B. Perform tests and inspections with the assistance of a factory-authorized service representative.
C. PV module will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

END OF SECTION

SECTION 263200 - GENERATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 SCOPE

A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.

B. The generator set and transfer switches shall be manufactured and supplied by the same manufacturer, so there is one source for warranty and product service.

C. Provide factory test, and on-site startup, testing and commissioning by factory trained and authorized personnel on-site testing of the system.

D. See Section 26 4313 for additional requirements.

1.3 CODES AND STANDARDS

A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.

1. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
2. NFPA70 – National Electrical Code.
3. NFPA110 – Emergency and Standby Power Systems, if applicable.
4. IBC – 2009 Ip 1.0.
5. Comply with Washington State Emissions Regulations Chapter 173-460 WAC – Controls for New Sources of Toxic Air Pollutants.

B. The generator set and supplied accessories shall meet the requirements of the following standards:

1. NEMA MG1. Alternator shall comply with the requirements of the current version of this standard as they apply to AC alternators.
2. UL142 – Sub-base Tanks
3. UL1236 – Battery Chargers
4. UL2200 - The generator set shall be listed to UL2200.

C. The control system for the generator set shall comply with the following requirements.

1. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2:
2. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics
3. FCC Part 15, Subpart B.
4. IEC8528 part 4. Control Systems for Generator Sets
5. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
6. UL508. The entire control system of the generator set shall be UL508 listed and labeled.

D. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.4 ACCEPTABLE MANUFACTURERS & DISTRIBUTORS

A. Only approved bidders shall supply equipment provided under this contract. Equipment specifications for this project are based on generator sets manufactured by Cummins Power Generation with microprocessor-based controls. Equipment by other suppliers that meets the requirement of this specification will be considered if submitted for review and approval to the

engineer not less than 10 days before scheduled bid date. Approved equipment will be identified by addenda. Proposals must include a line by line compliance statement based on this specification.

Cummins Power Generation as supplied by Cummins Northwest

1. Only (factory direct or first tier) distributors shall be acceptable, (second tier) dealers are not approved, to supply the approved manufacturers.
2. Only approved local distributors shall supply equipment provided under this contract. Equipment by non-local distributors shall not be acceptable.
3. The distributor shall be the authorized engine distributor for the prime mover.
4. The local representative shall have represented the manufacturer for a minimum of 10 years.
5. On request, they shall provide a reference list of five similar projects, no older than 2 years with site contact information.
6. They shall have a field service group dedicated to generator repair and maintenance that has no fewer than 10 technicians with dedicated service vehicles with parts and tooling needed for common repairs.
7. They shall provide service within four (4) hours of a request for service or warranty.
8. Field service technicians shall have a minimum of 2 years of generator field experience on the product being supplied and shall be factory trained and certified.
9. Field service technicians shall have a EL-O7 Maintenance Electrical License as issued by the Washington Department of Labor and Industries.
10. Bidders will not be considered unless there is a local office and stocking warehouse within 150 miles of the project site.
11. Shall have a stocked warehouse space a minimum of 15,000 square feet within 150 miles of the job site.
12. Shall provided formal classroom training for service and maintenance on generators and transfer switches on a regular basis. The schedule and pricing for this training shall be available on request.
13. Warranty shall be by this distributor; not off set to either an engine manufacturer, alternator manufacturer, or a first tier distributor.

B. Power Systems West (Kohler Generator)

C. Pacific Power Group (MTU Onsite Energy)

D. Approved equal. Submit all data in writing (with electronic copy) for pre-approvals 14 days prior to bid date. All variations to the specified equipment shall be summarized and highlighted for review by the engineer. Phone requests will not be accepted.

PART 2 - PRODUCTS

2.1 GENERATOR SET

A. Ratings

1. The generator set shall operate at a voltage of: 120/208, 3-Phase, 4-wire., 60 hertz.
2. The generator set shall be rated at 400kW, 500kVA at 0.8 PF, Standby rating, based on site conditions of: Altitude 500 ft., ambient temperatures up to 122 degrees F.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. The initial voltage drop on generator output due to starting currents of loads shall not exceed 15 percent.

3. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5%.
4. The diesel engine generator set shall accept a single step load of 100% nameplate kW and power factor, with the engine generator set at operating temperature.
5. Motor starting capability shall be a minimum of 750 kVA. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified kVA load at near zero power factor applied to the generator set. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes shall not exceed 25%.
6. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.
7. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction
1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. Provide vibration isolators between the engine generator assembly and the structural skid base. The base shall incorporate a battery tray with hold-down clamps within the rails.
2. Comply with latest edition of International Building Code Seismic equipment factor Ip 1.0.

2.2 ENGINE AND ENGINE EQUIPMENT

A. The engine shall be diesel, 4 cycle, radiator and liquid cooled, producing 1.5HP per kW to operate at 1800 rpm for full electrical output rating. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories.
B. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed.
C. Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the alternator air inlet. Radiator shall be prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange if generator is to be installed indoor. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental contact.
D. Electric starter(s) capable of three complete cranking cycles without overheating.
E. Full flow lubrication oil filters with replaceable spin on canister elements.
F. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler if required for operation due to the design of the engine and the installation.
G. Replaceable dry element air cleaner with restriction indicator.
H. Engine battery charging alternator, 40-ampere minimum and solid-state voltage regulator.

I. Flexible supply and return fuel lines.
J. Comply with Washington State Emissions Regulations Chapter 173-460 WAC – Controls for New Sources of Toxic Air Pollutions Tier 3.

2.3 AC ALTERNATOR

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 80 degrees Centigrade.
B. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of providing sufficient excitation for the alternator to supply approximately 300% of rated current for not more than 10 seconds.

2.4 GENERATOR SET CONTROL

The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, protection and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a UL/NEMA 3R enclosure. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

A. Control Switches
   1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
   2. EMERGENCY STOP switch. Switch shall be Red "mushroom head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
   3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
   4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
   5. VOLTAGE AND FREQUENCY ADJUSTMENT: The genset control shall include digital raise/lower switches for adjustment of voltage and frequency.
B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:
   1. Digital metering set, 1% accuracy, to indicate generator RMS voltage and current,

frequency, and total load on generator set. Generator output voltage shall be available in line-to-line and line-to-neutral voltages.

2. Generator control shall contain analog meters displaying the following data: Line-to-neutral AC volts for each phase, line-to-line AC volts, AC current for each phase, frequency, and total load as a percentage of rated load capacity. Both analog and digital metering are required.
3. Generator Set Alarm and Status Display.

C. Generator Set Alarm and Status Display.

1. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. At a minimum the control shall have separate indication lamps to indicate the following: NOT IN AUTO, SHUTDOWN, WARNING, REMOTE START, AUTO MODE, MANUAL RUN.
2. The generator set control shall indicate the existence of all alarm, shutdown, and status conditions associated with the generator set, on an alphanumeric display on the generator set control.
3. The generator set shall indicate the existence of warning and shutdown conditions on the generator set control panel for all of the following conditions:
   Low oil pressure (warning and shutdown)
   oil pressure sender failure (warning)
   low coolant temperature (warning)
   high coolant temperature (warning and shutdown)
   engine temperature sender failure (warning)
   low coolant level (shutdown)
   fail to crank (shutdown)
   fail to start/overcrank (shutdown)
   overspeed (shutdown)
   low and high battery voltage (warning)
   weak battery (warning)
   low fuel level (warning)
   low and high AC voltage (shutdown)
   over and under frequency (shutdown)
   over current (warning and shutdown)
   field overload (shutdown)
   loss of sensing voltage (shutdown)
   emergency stop (shutdown)
4. The control system shall incorporate data logging of alarm conditions.
5. Provisions shall be made for indication of minimum two (2) customer specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions.

D. Engine Status Monitoring.

1. The following information shall be available from the alphanumeric display panel on the generator set control:
   engine oil pressure
   engine coolant temperature
   engine speed (rpm)
   number of hours of operation

number of start attempts
battery voltage

E. Engine Control Functions.
   1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
   2. The control system shall include the engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification.
   3. The control system shall include time delay start (adjustable 0 + 300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
   4. The control system shall include sender failure monitoring logic which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

F. Alternator Control Functions:
   1. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off.
      Adjustments shall be made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level.
   2. A microprocessor-based protection device shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 95% and 110% of the rated current of the generator set for more than 60 seconds. The device at 95% shall initiate a signal to the generator automatic load shed system controls. See Sheet E40.02. The automatic load shed system is provided by the contractor as part of the field investigation. The device at 110% shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
   3. The control shall provide alternator protection from the following conditions: high or low voltage, over/under frequency, over current warning/shutdown, loss of voltage sensing, and field overload shutdown.
   4. A microprocessor-based AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

G. Control Interfaces for Remote Monitoring:

1. The control system shall provide three generator status output relays. These relays shall be configured to indicate: (1) generator set running, (2) common warning, and (3) common shutdown.

2.5 OTHER EQUIPMENT TO BE PROVIDED WITH THE GENERATOR SET

A. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on Sheet E-308 The remote annunciator shall provide all the audible and visual alarms called for by NFPA-110. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2.

B. The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Level	Amber	Yes
Network OK	Green	Yes
(4) Spares	Configurable	Configurable

C. Outdoor Weather-Protective Enclosure

1. The generator set shall be provided with an outdoor enclosure, with the entire package listed under UL2200. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100F. The housing shall have lockable hinged access doors as required to maintain easy access for all operating and service functions. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure.
2. The outdoor weather protective enclosure shall be made of Steel.

3. The enclosure shall be insulated with non-hydroscopic materials, and reduce the sound level of the generator set while operating at full rated load to a maximum of 75 dBA as measured at 7 meters from the generator set in a free field environment.
4. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two-step electro coating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:
   Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
   Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
   Crosshatch adhesion, per ASTM D3359-93, 4B-5B.
   Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
   Salt Spray, per ASTM B117-90, 1000+ hours.
   Humidity, per ASTM D2247-92, 1000+ hours.
   Water Soak, per ASTM D2247-92, 1000+ hours.
5. All enclosure external hardware shall be corrosion resistant and hinges shall be stainless steel.
6. A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.
7. The enclosure shall include a flexible oil drain line that extends to the exterior of the enclosure, and an external radiator fill provision.

D. The generator set shall be provided with a mounted main line circuit breaker(s), sized to carry the rated output current of the generator set, or as indicated on the drawings. The supplier shall provide circuit breaker(s) per electrical power riser diagram. This information must accompany generator shop drawings. The supplier shall, upon request, submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

E. Provide a dual wall sub-base fuel storage tank sized to allow for full load operation of the generator set for 24 hours at full load. The tank shall be constructed of corrosion resistant steel and shall be UL 142 listed. The equipment, as installed by the Contractor, shall meet all local and regional requirements for the application. Tank shall include the following features:
   1. Emergency tank and basin vents, mechanical level gauge, and basin drain.
   2. Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to UL2200 and NFPA 37 requirements.
   3. Leak detection provision and high and low fuel level float switches wired to the generator set control for local and remote alarm indication.
   4. 2-in ‘Main Vent’ with atmospheric cap (extended outside of the enclosure 12’ above grade).
   5. Emergency Vent (extended outside of enclosure).
   6. Secondary Emergency Vent (extended outside of enclosure).
   7. 5- gallon spill/fill bucket.

F. Provide a fully automatic battery charger, sized as appropriate for the engine and batteries, as recommended by the engine manufacturer. The charger shall be UL-labeled for use in emergency applications, and shall include all features necessary to meet NFPA-110

requirements.

G. Thermostatically controlled UL499 Listed coolant heater, sized as recommended by the engine manufacturer to warm the engine to a minimum of 104F (40C) in a 40F (4C) ambient, in compliance with NFPA-110. Voltage shall be as shown on the project drawings. Coolant heater shall have provisions to isolate the heater for replacement of the heater element without draining the coolant from the generator set.

H. Provide engine starting batteries. Starting batteries shall be calcium/lead antimony type, 12 or 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors. The batteries shall be capable of a minimum of three complete 15-second cranking cycles at 40F ambient temperature when fully charged.

PART 3 - OTHER REQUIREMENTS

3.1 SUBMITTALS

A. After award of contract and upon request, provide submittals. Submittal documents shall be electronic PDF format, and shall be of original document quality, clearly marked to indicate equipment options and accessories to comply with the specifications. PDF scans of hand marked documents will be rejected and returned for re-submittal.

B. Submittal documents shall contain the following information:
Bill of Materials, including a description of any differences between the specified and the proposed equipment.
Manufacturer's product literature, model specifications and performance data, sufficient to verify compliance to specification requirements.
Manufacturer's certification of prototype testing.
Manufacturer's document of EPA certification for proposed model generator.
Manufacturer's published warranty documents.
Outline drawings showing overall dimensions of generator and accessories.
Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
Seismic certification, as required by the site.

3.2 FACTORY TESTING

A. The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided.

B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks notice for testing.

C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

3.3 INSTALLATION

A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction and with manufacturer's installation instructions.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Equipment shall be installed on a concrete pad. Equipment shall be permanently fastened to

the pad in accordance with manufacturer's instructions and seismic requirements of the site.

D. Equipment shall be initially started, tested and operated by representatives of the manufacturer. Contractor shall furnish all fluids necessary for testing and fill diesel fuel tank upon notice of substantial completion.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing.

3.4 ON-SITE ACCEPTANCE TEST

A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fluids and fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

B. Installation acceptance tests to be conducted on site shall include a "cold start" test, a two hour full load test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test.

C. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

D. The generator set supplier shall issue a test report documenting the results of all testing with and without load bank and including a complete list of all settings in the control system.

E. As part of the on-site testing contractor shall coordinate testing schedule with Owner's Third-Party Commissioning Representative. Commissioning Representative shall be on-site during testing and shall be provided a copy of the testing report at completion.

3.5 TRAINING

A. The equipment supplier shall upon request, provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be for a single visit not less than 4 hours in duration. Training date shall be coordinated with the facility owner.

3.6 SERVICE AND SUPPORT

A. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

3.7 WARRANTY

A. The generator set and associated equipment shall be warranted for a period of not less than 1 year from the date of final acceptance against defects in materials and workmanship. The warranty shall be comprehensive, including parts, labor, and travel.

END OF SECTION

SECTION 263623 – AUTOMATIC TRANSFER SWITCH

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 SCOPE

A. Provide a complete factory assembled automatic transfer switch with field programmable digital electronic controls designed for fully automatic operation and including: surge voltage isolation, voltage sensors on all phases of both sources, AC powered operator, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

B. The transfer switch and generator set shall be of the same supplier to provide a single source of responsibility for all the products provided. Technicians specifically trained, tested and certified to support the product shall service the transfer switches.

1.3 CODES AND STANDARDS

A. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:

1. UL1008 – Transfer Switches. Transfer switches and enclosures shall be UL1008 listed as a package, and labeled to be suitable for use in emergency, legally required, and optional standby applications.
2. IBC2006 – The transfer switch(es) shall be prototype-tested and 3rd party certified to comply with the requirements of the IBC group III or IV, category D/F. The equipment shall be shipped with installation instructions necessary to attain installation compliance.
3. CSA 282, Emergency Electrical Power Supply for Buildings
4. NFPA70 – National Electrical Code.
5. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.
6. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
7. NEMA ICS10-1993 – AC Automatic Transfer Switches.

B. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.4 ACCEPTABLE MANUFACTURERS

A. Only approved bidders shall supply equipment provided under this contract. Equipment specifications for this project are based on transfer switches manufactured by Cummins Power Generation. Equipment by other suppliers that meets the requirements of this specification may be submitted for engineers review and approval a minimum of 10 days prior to scheduled bid date. Proposals must include a line by line compliance statement based on this specification.

B. Prior Approved Manufacturers:

a. Pacific Power Systems
b. Power Systems West

1.5 QUALIFICATIONS

A. The automatic transfer switch shall be of the same supplier as the generator, to provide a single source of responsibility for all the products provided.

B. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

C. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

A. Ratings

1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 Volts AC minimum.
3. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).
4. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes not less than the available fault currents shown on the drawings and at the specified voltage.

2.2 TRANSFER SWITCH CONTROL (OTPC)

A. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

1. High intensity LED lamps to indicate Source 1 and Source 2 available, and which source the load is connected to. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.
2. High intensity LED lamp to indicate that the control system is testing or exercising the generator set.
3. "TEST" pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.
4. "RESET/LAMP TEST" push button that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.
5. The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via a PC-based service tool and the integral operator display panel.
6. Analog AC meter display panel, to display 3-phase AC Amps, 3-phase AC Volts, Hz, KW load level, and load power factor. The display shall be color-coded, with green scale indicating normal or acceptable operating level, yellow indicating conditions nearing a fault, and red indicating operation in excess of rated conditions for the transfer switch.
7. Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities:
    a. Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance. Line to neutral voltages shall be displayed for 4-wire systems.

b. Display source status, to indicate source is connected or not connected.
c. Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, KW, KVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.
d. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:
    1) Set nominal voltage and frequency for the transfer switch.
    2) Adjust voltage and frequency sensor operation set points.
    3) Set up time clock functions.
    4) Set up load sequence functions.
    5) Enable or disable control functions in the transfer switch, including program transition.
    6) Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.
e. Display Real time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.
f. Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.
g. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

B. Internal Controls
1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:
    a. Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).
    b. Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).
    c. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.
    d. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).
    e. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

3. All transfer switch sensing shall be configurable from a Windows XP or later PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. Designs utilizing DIP switches or other electromechanical devices are not acceptable. The transfer control shall incorporate a series of diagnostic LED lamps.
4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature. A phase band monitor or similar device is not an acceptable alternate for this feature.
5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cooldown) (adjustable in a range of 0-30 minutes).
6. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
7. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
8. The control system shall be designed and prototype tested for operation in ambient temperatures from -30C to +60C and up to 95% humidity. It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.

C. Control Interface
1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.
2. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
3. The transfer switch shall provide relay contacts to indicate the following conditions: source 1 available, load connected to source 1, source 2 available, source 2 connected to load.
4. The transfer switch shall be provided with a network communication card, and configured to allow network-based communication with the transfer switch and other network system components.
5. The transfer switch shall provide a relay contact signal prior to transfer or retransfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
6. Provide dry contact output to signal transfer switch in generator position for use by lighting control.

2.3 ENCLOSURE

A. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70. The cabinet door shall include permanently mounted key type latch(es). Bolted covers or doors are not acceptable.
B. Transfer switch equipment shall be provided in a NEMA Type 1 enclosure. All enclosures shall be 3rd party certified for compliance to the required NEMA standards.
C. Manual operating handles shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

PART 3 - OPERATION

3.1 OPEN TRANSITION SEQUENCE OF OPERATION

A. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.

B. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
2. When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect load to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later.
   The timing sequence for the contact operation shall be programmable in the controller.
3. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.
4. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
5. The transfer switch shall operate the generator set unloaded for a cool down period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

PART 4 - OTHER REQUIREMENTS

4.1 FACTORY TESTING

A. The transfer switch manufacturer shall perform a complete operational test on the transfer switch prior to shipping from the factory. A certified test report shall be available on request. Test process shall include calibration of voltage sensors.

4.2 SERVICE, SUPPORT AND TRAINING

A. The transfer switch shall be serviced by a local service organization that is trained and factory certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

B. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

C. After generator set installation, the generator set supplier shall conduct a complete operation, basic maintenance, and emergency service seminar for up to 10 persons employed by the facility owner. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of maintenance tools provided under this contract, and emergency operation procedures. The class duration shall be conducted during a single visit to the customer location.

4.3 SUBMITTALS

A. After award of contract and upon request, provide 3 sets of submittals. Submittal documents shall be paper, and shall be of original document quality, clearly marked to indicate equipment

options and accessories to comply with the specifications. Photocopies of hand marked documents will be rejected and returned for re-submittal. Submittal documents shall contain the following information:

1. Bill of Materials, including a description of any differences between the specified and the proposed equipment.
2. Manufacturer's product literature, model specifications and performance data, sufficient to verify compliance to specification requirements. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch.
3. Manufacturer's certification of prototype testing.
4. Manufacturer's published warranty documents.
5. Outline drawings showing overall dimensions of the assembly.
6. Internal electrical wiring and control drawings.
7. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
8. Seismic certification, as required by the site.

4.4 WARRANTY

A. The generator set and associated equipment shall be warranted for a period of not less than 1 years from the date of final acceptance against defects in materials and workmanship. The warranty shall be comprehensive, including parts, labor, and travel.

END OF SECTION

SECTION 264313 – TRANSIENT VOLTAGE SURGE SUPPRESSION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section describes the materials and installation requirements for Surge Protective Devices (SPD). SPD's are used for the protection of all AC electrical circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

B. This specification also describes the mechanical and the electrical requirements for the SPD. The SPD shall be suitable for application in both category B and C environments as described in ANSI/IEEE C62.41- 2002.

C. The Manufacturer/Vendor shall furnish all of the necessary SPD products and related hardware (i.e. flush mounting kits, mounting brackets, etc.) as required for the installation of

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. VPR: Voltage Protection Rating.

C. SPD: Surge Protective Device, replacement acronym for TVSS: Transient Voltage Surge Suppressor

D. CLF: Component Level Fusing

E. LIC: Low Impedance Cable

F. SCCR: Short Circuit Current Rating

1.4 REFERENCE STANDARDS

A. All manufacturers must comply with the standards listed below and any additions current revisions of industry standards. All products that do not comply with current industry standards will not be accepted.

1. Underwriters Laboratories 1449 – (UL 1449) 3rd Edition
2. NEC article 285. National Electrical Code 2008
3. NFPA 780 Standard for the installation of lightning protection systems
4. UL96A – Lightning Protection System Master Label
5. IEEE (Institute of Electrical and Electronic Engineering Inc.) Latest Revision C62.41.1, C62.41.2, C62.45, C62.33 & C62.35
6. Previous NEMA LS-1 testing standards
7. ISO 9001 (International Organization for Standardization) Quality Systems – Quality Management System

1.5 SUBMITTALS

A. Submittals shall include written specification response referencing each specification section and sub-section indicating compliance or non-compliance. If manufacturer cannot fully comply with specification section, this must be stated in the response along with a full description of the variance. Submittal responses shall be signed by manufacturer's VP of Engineering or Product Line Manager.

B. Submit the following information, indexed by response and test results.

1. Specification compliance response sheet referencing each specification section.
2. Proof of UL1449 Third Edition compliance from Nationally Recognized Test Lab (NRTL) accepted by local authority having jurisdiction. UL1449 Third Edition Nominal Discharge Current Rating and Voltage Protection Ratings shall be provided.

3. Published specifications, cut sheets & product data with appropriate IEEE C62.41 & UL1449 Third Edition performance ratings for intended installation locations.
4. Electrical and mechanical shop drawings.
5. Installation requirements/instructions.
6. Operations & maintenance manuals.
7. Performance / warranty information.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manuals
B. Warranty Documentation

1.7 DELIVERY, STORAGE AND HANDLING

A. Inspect for damage and replace any damaged device.
B. Store in a clean, dry space suitable for equipment and protect against damage.
C. Clean equipment and touch up minor scratches using suitable materials.

1.8 QUALIFICATIONS

A. Manufacturer shall have local representation and distribution within 400 miles of the project location to provide technical, warranty claim, and installation support for the project.
B. Manufacturer/vendor must be capable of supplying SPD for project within 30 days of receipt of order for orders of 25 units and less for models submitted in response to this specification.
C. Manufacturers shall be certified to latest ISO 9001 standard and shall be registered for the design and manufacturing of SPD devices.
D. Manufacturer shall provide access to a readily available factory engineer for answering questions about this product.
E. Manufacturer qualifications shall be provided as part of the submittal.
F. The successful manufacturer/vendor shall assign a technical contact person for SPD application, installation and warranty questions. This contact shall be available to provide a response to a technical question within a maximum of two business days.
G. All SPDs for this project must be supplied by the same manufacture.

PART 2 - PROCUCTS

2.1 ACCEPTABLE “PRE-APPROVED” MANUFACTURES/MODELS

A. Total Protection Solutions – Contact Power Solutions NW (206) 930-1980

Total Protection Solutions (TPS) ServiceTrack & LowProfile Series					
Voltage / Application	480Y277v 3 Phase Wye	480v 3 Phase Delta	208Y120v 3 Phase Wye	208v 3 Phase Delta	120/240v Single / Split Phase
Main Services	ST240-3Y480-FL	ST240-480NN-FL	ST240-3Y208-FL	ST240-240NN-FL	ST240-1S240-FL
Distribution, MCC & Branch Panels	LP120-3Y480-FL	ST120-480NN-FL	LP120-3Y208-FL	ST120-240NN-FL	LP120-1S240-FL
Use Delta units for all unbonded/ungrounded & high resistance ground Wye applications.					

B. Low Impedance Cable: Required for all installations with lead lengths over 36”

1. Total Protection Solutions (TPS)
    a. Main Services – LIC-6X-xx
    b. All other applications – LIC-10X-xx
    c. (Where xx denotes length in feet; 5', 10', 15')

C. Approved Alternate Manufacturer's:
1. Siemens Industry, LLC – UL Listed with Electrical Switchboards and Panelboards.

2.2 SURGE CURRENT RATINGS

A. Minimum Single Impulse Ratings with Independent testing per previous NEMA LS1.

Main Services	240kA per Phase, 120kA per Mode
Distribution, MCC & Branch Panels	120kA per Phase, 60kA per Mode

2.3 TYPE

A. External, non-modular SPD/TVSS required for all applications (not integrated with gear/panels) connected in parallel to switchgear via dedicated circuit breaker.

2.4 LISTINGS: UL1449 3RD EDITION, UL96A & NFPA 780 (OR CURRENT REVISION)

A. Type 1 & 2: Suitable for applications including direct buss connection with no additional overcurrent protection requirements.
B. Nominal Discharge Current (In): 20kA for Main Service and 10kA for all other applications (for compliance to NFPA 780, NEC 280 and UL96A Lightning Protection Master Label).
C. SCCR: 200KA Short Circuit Current Rating with no additional/external overcurrent protection.

2.5 MODES OF PROTECTION - ALL MODES FOR ALL CONFIGURATIONS AND

A. WYE: Discrete MOV Line to Neutral, Line to Ground, Neutral to Ground
B. Delta: Discrete MOV Line to Line & Line to Ground
C. Sinewave tracking transient filter protection for all modes on Wye & L-L for Delta.

2.6 LOW IMPEDANCE CABLE (LIC):

A. An LIC must be available from the SPD manufacture that reduces effective lead impedance by 75% and be used for all SPD installations with lead lengths exceeding 36".

2.7 DURABILITY TESTING

A. TVSS/SPD devices shall withstand a minimum of 5,000 hits delivered at a rate of one pulse per minute. Unit shall not fail or suffer let through voltage degradation of more than 7%. Lead length for testing and let through measurements shall be 6".

2.8 COMPONENT LEVEL FUSING

A. Balanced array MOV based SPD/TVSS with individual Component Level Fusing (Oxygen Free High Conductivity [OFHC] elements in silica sand) are required for all components.

2.9 SPD MUST NOT HAVE, USE OR REQUIRE ANY OF THE FOLLOWING

A. Board trace fuses, crowbar type gas tube arrestors or SAD devices are not allowed.
B. Integrated primary overcurrent protection Fuses or Circuit Breakers are not allowed.
C. SPDs with external over-current protection requirements (UL Type-2 listing only) are not allowed.

2.10 SAFETY

A. SPD must not fail catastrophically when a continuous over-voltage is applied to 6 modes simultaneously (Line-Neutral & Line-Ground * 3 Phases). UL1449 only requires one mode be

tested at a time.

2.11 MONITORING

A. Green “Phase Status” LEDs, Red “Service Required” LED, Dry Contacts & Audible Alarm w/silence button are required. SPD must not rely solely on primary overcurrent protection (no CLF), as this will likely open up on SPD failure, thus disabling the alarm (no power, no alarm).

2.12 SERVICE CONDITIONS

A. SPDs shall be rated for continuous operation under the following conditions, unless otherwise indicated:
   1. Maximum Continuous Operating Voltage (MCOV) above nominal – Minimum 115%.
   2. Enclosures: Heavy duty, powder coated steel with appropriate NEMA rating for application.
   3. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
   4. Humidity: 0 to 85 percent, non-condensing.
   5. Altitude: Up to 13,000 feet (4,000 m) above sea level.
   6. Noise Level: SPD shall not emit any audible noise unless “in alarm” indicating a “service required” condition.

2.13 DIMENSIONS (MAXIMUM):

A. MSB – 16”Hx13”Wx7”D; MCC/Dist/Branch – 4”Wx4”Dx10”H. Compact SPD dimensions are critical for achieving installations with short leads.

2.14 FLUSH COVER PLATE

A. Manufacture must provide smoked acrylic cover plates for flush mounting applications.

2.15 MAXIMUM LET THROUGH VOLTAGES (LTV)

A. Tested w/6” leads & 500MHz Scope from 0 ref per NEMA-LS1

MAIN SERVICE APPLICATIONS

Voltage Configuration	Test Waveform	L-N	L-G	L-L	N-G	Phase º
480/277 Wye	IEEE C3 – 20 kV/10ka	1187	1540	1950	1500	90º
	UL VPR – 6 kV/3kA	1200	1200	1800	1200	90º
	IEEE A1 – 2kV – 67A	44	77	54	52	180º
120/208 Wye	IEEE C3 – 20 kV/10kA	907	1173	1267	1090	90º
	UL VPR – 6 kV/3kA	800	800	1200	800	90º
	IEEE A1 – 2kV – 67A	40	76	54	46	180º
480/277 Wye	UL VPR – 6 kV/3kA	1200	1200	2000	1200	90º
	IEEE A3 – 6kV – 200A	71	119	73	67	180º
	IEEE A1 – 2kV – 67A	27	52	39	48	180
120/208 Wye	UL VPR – 6 kV/3kA	700	700	1200	700	90º
	IEEE A3 – 6kV – 200A	56	81	88	112	180º
	IEEE A1 – 2kV – 67A	29	46	39	40	180º

2.16 WARRANTY

A. Warranty:
   1. SPD Manufacturer’s Warranty: shall provide a product warranty for a period of not less

than thirty (30) years from date of installation. Warranty shall cover unlimited, complete replacement of TVSS devices during the warranty period with no exceptions for lightning, utility accidents etc.

2. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents. Those firms responding to this specification shall provide proof that they have been regularly engaged in the design, manufacturing and testing of TVSS for not less than five (5) years.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION

A. Training: Onsite installation training for the contractor must be provided by the SPD supplier.

B. Review all installation information in manufacturer's installation manual prior to installing SPD's

3.2 INSTALLATION

A. GENERAL

1. Verify all voltages before connecting to avoid injury and damage to equipment.
2. The SPD's shall be installed external to switchboard, distribution and panelboard.
3. Internally mounted SPD's will not be accepted.
4. Ground resistance shall be 25 ohms or less per NEC Article 250.56
5. Suppressors shall be installed per the manufacturer's installation instructions and the requirements of: the NEC, the local authority having jurisdiction and the project engineer.
6. Project Engineer or their appointed representative may perform inspection of the installed suppressors and reserves the right to require corrections to the installation to comply with manufacturer's installation requirements and project specifications.
7. The SPD/TVSS supplier must provide on-site installation training for the electrical contractor.
8. All circuit breakers feeding SPDs much have locking safety clips installed to prevent the circuit breaker from inadvertently being turned off.

B. SERVICE ENTRANCE

1. Install one primary suppressor at each utility service entrance to the facility as indicated on the drawings and/or as noted on the panel schedules.
2. Suppressor shall be installed on the load side of the service entrance disconnecting means unless noted otherwise by the project engineer.
3. Provide a 100 Amp circuit breaker (with a safety clip to ensure the circuit breaker cannot be inadvertently turned off) in the switchboard as over-current protection for the wire and as a disconnecting means for the SPD.
   a. Only UL1449 Type-1 devices are allowed, so by definition of Type-1, the manufacture cannot have any external overcurrent protection requirements. If the SPD manufacture does have external overcurrent protection requirements, that SPD equipment will not be accepted.
4. Use minimum #4 AWG wire for connecting the SPD.
5. Conductors between suppressor and point of attachment shall be kept as short and straight as possible. Lead length of connecting conductor shall not exceed two (2) feet without written permission of the specifying Engineer.
6. Whenever possible, SPD leads must be twisted together and securely tie-wrapped together every 6" to reduce impedance of the leads.
7. Over-length SPD leads (greater than 36") must use Low Impedance Cable (see "Pre-

Approved" section 2.1-A for ordering information)

8 SPD leads must not be spliced.

9 Suppressor's ground shall be bonded to enclosure frame and the service entrance ground bus, and conduit between the TVSS/SPD and the switchboard must provide secure electrical/mechanical connections.

C. SECONDARY SPDs FOR MCC, DISTRIBUTION & BRANCH PANELS

1. Install one secondary suppressor at each MCC, Distribution Panel, Branch Panel & Sub-Panel location as indicated on the drawings.
2. Provide a 30 Amp circuit breaker (with a safety clip to ensure the circuit breaker cannot be inadvertently turned off) in the panel being protected as over-current protection for the wire and as a disconnecting means for the SPD.
   a. Only UL1449 Type-1 devices are allowed, so by definition of Type-1, the manufacture cannot have any external overcurrent protection requirements. If the SPD manufacture does have external overcurrent protection requirements, that SPD equipment will not be accepted.
3. Conductors between suppressor and point of attachment to the panelboard shall be kept as short and straight as possible. Mount the TVSS directly adjacent to the circuit breaker closest to the neutral bus, such that the maximum length of all connecting wiring is kept as short as possible, not exceed 18 inches.
4. Over-length SPD leads (greater than 18") must be twisted together (2 twists/foot) and securely tie-wrapped once per foot to reduce impedance of the leads. Quality compression butt-splice connections are required when extending SPD leads (wire nuts are not acceptable).
5. Grounding: Suppressor's ground lead shall be bonded to the panel enclosure with a small ground lug as close as possible to the TVSS mounting point. Conduit between the TVSS/SPD and the switchboard must provide secure electrical/mechanical connections.
   a. Isolated Ground (IG) Applications: The ground lead is bonded to the SPDs metal enclosure, so a non-metallic conduit must be used to isolate the SPD from the panel enclosure. The ground lead must then be connected to the IG buss.
6. Multiple "Feed-Through" Panels with shared SPD/TVSS units must be immediately adjacent to each other (side by side) with short tie cables not to exceed 36". Sub-panels must be feed from a primary panel with a "lug-out', lug-in" tie connection, and the tie connection lugs must be at the same end of the primary and sub-fed panel. i.e. bottom to bottom or top to top to ensure short tie "sub-feed" cables.

3.3 FIELD QUALITY CONTROL

A. A factory authorized representative shall inspect and photograph all SPD installations and report findings in writing to the project engineer.

3.4 STARTUP SERVICE

A. Do not energize or connect service entrance equipment or panelboards to their sources until SPD's are installed and connected.

B. Do not perform insulation resistance "Hipot" tests of the distribution wiring with the SPDs installed/connected. Disconnect before conducting insulation resistance tests and reconnect immediately after the testing is over.

END OF SECTION

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. The provisions and intent of the Contract, the General and Supplementary Conditions, Division 1 Specification Sections, and published addenda apply to the work as if specified in this Section.

B. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, LED module, drivers, emergency lighting units, and accessories.

C. Provide the lighting system complete and operational. All light fixtures shall be provided complete with LED module, mounting hardware and accessories required for operation.

D. Provide lighting fixtures of types, sizes and finish as listed on the drawings. Light Fixtures shall be complete assemblies constructed to ensure full life of components and minimize amplification and transmission of component generated noise.

E. Contractor shall include in the bid all costs and documentation for lighting control commissioning. Contractor shall provide the owner a complete report of test procedures and results indicating all lighting controls have been tested, adjusted and operate in accordance with approved plans and specifications per the authority having jurisdiction.

F. Light fixture schedule series numbers are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of LED, driver, finish trim, ceiling type, mounting hardware, ceiling trim or special requirements as specified hereinafter or as required by the particular installation(s). Provide complete light fixtures and drivers to correspond with the number of LED's, wattage, switching and/or size specified. Refer to light fixture schedule, Architectural drawings, and schedules for additional requirements.

G. Light fixture voltage shall match voltage of circuit serving the light fixture. Contractor as part of the billing and submittal process shall verify each light fixture and notify engineer in writing of any conflicts.

1.2 REFERENCES

A. Shall be as follows:
National Electrical Manufacturer's Association (NEMA):
LE 5-1993 Procedure for determining luminaire efficiency ratings.

1.3 QUALITY ASSURANCE

A. Listing and Labeling: Provide light fixtures, emergency lighting units, and accessories Listed and Labeled as defined in NFPA 70, Article 100 and marked for intended use for the location and environment in which installed.

B. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.4 SUBMITTALS

A. Submittals shall be neatly and clearly marked to indicate the light fixture(s), LED module and drivers fully comply with contract documents. When substitute light fixtures are submitted (if permitted) the data shall clearly cross reference (written and highlighted) the substitute light fixture complies with every detail of the specified light fixture. Light fixtures not fully complying with contract documents are not permitted.

B. Submittals shall have light fixture types and project name clearly indicated and shall be prepared by the authorized manufacturer's representative serving the project area. A list of manufacturer representatives (including address, telephone and fax numbers) identifying which light fixture types they represent shall be included with submittals. Submittals or requests for prior approval not meeting these requirements will be rejected.

C. For light fixtures mounted in continuous rows, submit scaled drawings prepared by the light fixture manufacturer showing all details of construction, lengths of runs, weight pendant and power feed locations, accessory pieces, finishes method of field assembly and list of materials.
D. Contractor to provide manufacturer with accurate field dimensions where required.
E. Prior to receiving Engineers approval contractor shall schedule a meeting at the Engineers office with the light fixture manufacturer(s) representative, light fixture equipment supplier, engineer and contractor to review ceiling types, mounting heights, LED module, drivers, voltage, controls and colors. Provide shop drawings and catalog data to the engineer a minimum of five (5) days prior to the review meeting.
F. Product Data: For each type of lighting fixture indicated on the drawing E0.00, lighting fixture schedule, arranged in order of light fixture designation. Include data on features, accessories, and the following:
    1. Dimensions of light fixtures.
    2. Certified results of independent laboratory tests for light fixtures and LED module for electrical ratings and photometric data.
    3. Emergency lighting unit battery and charger.
    4. Types of LED's, color temperatures and (LPW) lumens per watt.
G. Wiring Diagrams: Detail wiring for light fixtures that clearly differentiates between manufacturer-installed and field-installed wiring.
H. Delete paragraph below if not required.
I. Product Certificates: Signed by manufacturer(s) or their designated representatives stating lighting fixtures certifying that products comply with drawing and specification requirements.
J. Dimming Driver Compatibility Certificates: Signed by manufacturer of driver certifying drivers are compatible with dimming systems and equipment with which dimming drivers are to be used.

1.5 SUBSTITUTIONS

A. Lighting fixtures designated for this project are based on the light fixture types and manufacturers specified. If substitution of light fixtures other than those specified is desired, then product information must be submitted, and prior to bid approved by the Engineer. All substation requests must be received in the Engineers office a minimum of 10-days prior to bid time. No requests for substitution will be accepted after this date.
B. Substitution requests shall include all information required under 1.04 SUBMITTALS of this section. Requests for prior approval shall be accompanied by a working light fixture sample (including LED module, drivers, cord and plug). Provide the name of at least one installation where each proposed substitute has been installed for at least six months. Provide the name and telephone number of the Engineer of Record.

1.6 COORDINATION

A. Lighting Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.
B. Coordination Meetings: Contractor shall meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each light fixture mounting condition with ceiling type.
C. During second meeting, coordinate light fixture layout in each area. Contractor shall meet at least twice with the mechanical systems installer prior to fabrication and installation of ductwork. Coordinate depth and location of all light fixtures and ductwork in all areas.

D. Contractor is responsible to provide School District's Energy Management Department with any information requested for the utility incentive program.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this section shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties under requirements of the Contract Documents.

B. Special Warranty for Batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.

C. Special Warranty Period for Batteries: Manufacturer's standard, but not less than 10 years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for last nine years.

D. Special Warranties for LED Drivers: Written warranty, executed by manufacturer agreeing to replace LED drivers, including labor for driver failure in materials or workmanship within specified warranty period.

1. Special Warranty Period for LED Drivers: Five years from date of manufacture, but not less than four years from date of Substantial Completion.

E. Light Fixtures Utilizing LED Lamp Technology: Provide manufacturer's warranty for a period of not less than 5 years including parts and labor for full replacement of defective product.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES AND LIGHTING FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit re-lamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during re-lamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. Whit Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.

2.2 LED MODULES AND LED DRIVERS

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:
    a. Minimum efficiency: 85% at full load.
    b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
    c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
    d. Integral short circuit, open circuit, and overload protection.
    e. Power Factor: ≥ 0.95.
    f. Total Harmonic Distortion: ≤ 20%.
    g. Comply with FCC 47 CFR Part 15.
4. LED modules shall include the following features unless otherwise indicated:
    a. Comply with IES LM-79 and LM-80 requirements.
    b. Minimum CRI 80 and color temperature 3500˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
    c. Minimum Rated Life: 50,000 hours per IES L70.
    d. Light output lumens as indicated in specified fixture literature.

B. LED Fixtures:
1. Housing, LED driver, and LED module shall be products of the same manufacturer.
2. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

2.3 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:
1. Sign Colors and Lettering Size: Comply with Authorities Having Jurisdiction.

B. Internally Lighted Signs: As follows:
1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
4. Self-diagnostic type with test switches and indicator lights.

2.4 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:
1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. LED module automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

4. Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.
5. Self-diagnostic type with test switches and indicator lights.

2.5 EMERGENCY LED POWER SUPPLY UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within light fixture body. Comply with UL 924.
   1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening light fixture or entering ceiling space.
   2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
   3. Charger: Fully automatic, solid-state, constant-current type.
   4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects LED module, and battery is automatically recharged and floated on charger.
B. External Type: Self-contained, modular, battery-inverter unit. Comply with UL 924.
   1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without entering ceiling space.
   2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
   3. Charger: Fully automatic, solid-state, constant-current type.
   4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects LED module, and battery is automatically recharged and floated on charger.
   5. Housing: NEMA 250, Class 1 enclosure.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Contractor shall provide “Seismic Controls for Electrical Work” such as channel- and angle-iron supports and nonmetallic channel and angle supports.
B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as light fixture.
C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single light fixture. Finish same as light fixture.
D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
E. Hook Hangers: Integrated assembly matched to light fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by light fixture manufacturer.

2.7 FINISHES

A. Fixtures: Manufacturer’s standard, unless otherwise indicated.
   1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
   2. Metallic Finish: Corrosion resistant.

2.8 OCCUPANCY SENSORS

A. Provide ceiling mounted occupancy sensors for control of lighting in areas not connected to building wireless lighting control system. Sensors shall be ceiling mounted to provide adequate coverage. Ceiling mounted occupancy sensors shall be compatible with wireless lighting control

system. Wall mounted occupancy sensors shall be Watt Stopper DT-100 complete with power pack. Locate wall mounted sensors at approximately 8'-0" above finished floor. Sensors shall be wired and installed per manufacturer's direction to maintain switching and circuits shown on drawings. Where multiple sensors are located in an individual room, sensors shall be wired parallel with the relays such that either sensor will provide input to turn all lights on and reset time delay.

B. The occupancy sensor shall have the following features:
   1. Dual Technology
   2. Low Voltage
   3. Adjustable Sensitivity
   4. Isolated NO/NC Contacts
   5. 30 second - 30 minute time delay

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each light fixture.

B. Verify mounting provisions prior to the ordering of fixtures. Fixtures shall be UL listed for the location, and application in which they are installed.

C. Install lighting fixture diffusers only after construction work, painting and clean up are completed. Prior to final acceptance, remove all, reflectors and diffusers, wash, rinse and reinstall.

3.2 SUPPORT OF LED FIXTURES

A. Recessed Downlight Type: Mount in frames suitable for the ceiling, with the recessed portion of the light fixture securely supported from the ceiling framing. For light fixtures supported by a ceiling suspension system, provide as a minimum or as required by ARJ, two safety chains secured to structural members above suspended ceiling.

B. Surface and Pendant Mounted Type:
   1. Where mounted on accessible ceilings, hang from structural members by means of hanger rods through ceiling or as approved.
   2. Continuous Runs of Light Fixtures: Straight when sighting from end to end, regardless of irregularities in the ceiling. Where light fixtures are so installed, omit ornamental ends between sections. For surface pendant mounted fixtures of three or more provide a unistrut channel for mounting fixtures. Provide 3/8-inch thread rod secured to structural members for support of unistrut channel.
   3. Provide surface mounted fluorescent light fixtures with UL approval for direct mounting on the various ceilings used. Spacers will not be approved where mounted on lay-in ceilings, support light fixtures by at least two positive devices which surround the ceiling runner, and which are supported from the structure above by a No. 12 gauge wire. Spring clips or clamps that connect only to the runner are not acceptable.

3.3 CONNECTIONS

A. Ground equipment
   1. 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.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed light fixture for damage. Replace damaged light fixtures and

components.

B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Test as follows:

1. Verify proper operation, switching and phasing of each light fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation. Verify normal transfer to battery source and retransfer to normal.
3. Report results in writing.

E. Malfunctioning Light Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.5 CLEANING AND ADJUSTING

A. Clean light fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

3.6 FIRE-RATED ENCLOSURES

A. The contractor shall provide 5/8” plasterboard minimum, taped box enclosures for all recessed light fixtures in 1 or 2-hour fire-rated ceilings, as required by local building or fire codes. Enclosure to provide minimum 3” air space around light fixture Contractor prior to bid shall verify Architectural drawings and specifications for areas where this provision is applicable.

3.7 CEILING TYPES

A. Refer to Architecture drawings. Provide flange trim where light fixtures are installed in GWB ceilings.

B. The Contractor prior to submitting shop drawings to the Engineer for review shall review the Architectural drawings to verify and coordinate the ceiling systems and lighting fixture frame requirements as well as proper ballast voltage. Contractor shall provide a written statement with the shop drawing submittal stating this has been completed.

3.8 OCCUPANCY SENSORS

A. Locate ceiling mounted sensors per manufacturer's recommendation and near the center of the room.

B. Set the time delay to 30 minutes.

C. Set the sensitivity level to 8.

D. Test each occupancy sensor to assure each is working properly.

END OF SECTION

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Posts, rails, and frames.
B. Wire fabric.
C. Manual gates with related hardware.
D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete anchorage for posts.
B. Section 087100 - Door Hardware: Gate hardware.

1.3 PRICE AND PAYMENT PROCEDURES

A. Allowances: See Section 012100 - Allowances, for cash allowances affecting this section.
B. Unit Prices: See Section 012200 - Unit Prices, for additional unit price requirements.
   1. Provide the work under the unit price method.
   2. Post Footings: Measurement and payment by each unit of footing, to the depth specified. Includes excavation, concrete placed, finishing.
   3. Gates: Measurement and payment by square foot. Includes frame posts, fabric, accessories, and hardware.

1.4 SUBMITTALS

A. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.
C. Samples: Submit two samples of fence fabric, 12 inch by 12 inch in size illustrating construction and colored finish.
D. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation anchor bolt templates, and locking mechanisms.
E. Manufacturer's Qualification Statement.
F. Fence Installer Qualification Statement.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
B. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with not less than five years of documented experience.

1.6 WARRANTY

A. See Section 017700 Closeout Procedures , for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Chain-Link Fencing:
   1. Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing.
   2. Minimum 6 feet high with galvanized-steel pipe posts.
   3. Minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.
B. Portable Chain-Link Fencing:
   1. Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing.
   2. Minimum 6 feet high with galvanized-steel pipe posts.

3. Minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails.
4. Provide concrete bases for supporting posts.

2.2 MATERIALS

A. Posts, Rails, and Frames:
1. ASTM A1011/A1011M, Designation SS; hot-rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum yield strength of 50 ksi; zinc coating complying with ASTM F1043 and ASTM F1083.

B. Wire Fabric:
1. ASTM A392 zinc coated steel chain link fabric.

2.3 MANUAL GATES AND RELATED HARDWARE

A. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates.

B. Hinges: Finished to match fence components.
1. Brackets: Round.
2. Mounting: Center.
3. Closing: Manual.
4. Products:
a. D&D Technologies USA, Inc; TruClose Heavy Duty: www.ddtechglobal.com/#sle.

C. Latches: Finished to match fence components.
1. Brackets: Round.
2. Locking: Magnetic.
3. Products:
a. D&D Technologies USA, Inc; LokkLatch: www.ddtechglobal.com/#sle.

2.4 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

2.5 FINISHES

A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 ounces per square foot.

B. Components and Fabric: Vinyl coated over coating of 1.8 ounces per square foot galvanizing.

C. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.

D. Accessories: Same finish as framing.

E. Color(s): Black.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

3.2 PREPARATION

A. Removal: Obstructions or debris.

3.3 INSTALLATION

A. Install framework, accessories and gates in accordance with ASTM F567.

B. Place fabric on outside of posts and rails.

C. Brace each gate and corner post to adjacent line post with horizontal center brace rail. Install brace rail one bay from end and gate posts.

D. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

E. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

F. Position bottom of fabric 2 inches above finished grade.

G. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

H. Install bottom tension wire stretched taut between terminal posts.
I. Do not attach the hinged side of gate to building wall; provide gate posts.
J. Install hardware and gate with fabric to match fence.
K. Perform one random field inspections confirming proper installation.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.
B. Maximum Offset From True Position: 1 inch.
C. Do not infringe on adjacent property lines.

3.5 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.
B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
C. Post Settings: Randomly inspect three locations against design for:
    1. Hole diameter.
    2. Hole depth.
    3. Hole spacing.
D. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.
E. Gates: Inspect for level, plumb, and alignment.
F. Workmanship: Verify neat installation free of defects. See CLFMI CLF-FIG0111 for field inspection guidance.

3.6 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
B. Clean fence with mild household detergent and clean water rinse well.
C. Dispose of all waste material in accordance with project's Waste Management Plan.
    1. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.7 CLOSEOUT ACTIVITIES

A. See Section 017700 Closeout Procedures, for closeout submittals.

END OF SECTION