



FORMAL BID 2026-006

**KITSAP COUNTY PUBLIC WORKS
DEPARTMENT, SEWER UTILITY
DIVISION**

FOR

**CENTRAL KITSAP TREATMENT PLANT
HVAC UPGRADES**

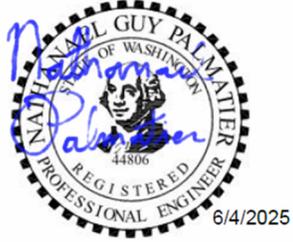
RESPONSE DEADLINE:

Thursday, February 26, 2026 AT 2:00 p.m.

SECTION 00 01 07 – SEALS PAGE

Professional Certification: I hereby certify that these documents were prepared or approved by me and that I am a duly registered Professional Engineer in the State of Washington. My stamp only applies to the sections listed below.

Name	Sections		Stamp
Nicholas Jacoby, PE License No. 56968	03 15 00 05 12 00 05 50 00		
Donn Stone, Jr., AIA License No. 7590	06 10 00 06 10 10 07 01 50.19 07 21 19 07 62 00 07 71 00 07 92 00	08 11 13 08 51 13 08 62 00 08 71 00 08 80 00 08 91 00 09 51 00 09 91 13 09 91 23	
Andrew Langdon, PE, LEED AP License No. 48289	Division 00 00 70 00 01 10 00 01 20 00 01 30 00 01 40 00 01 70 00 01 78 00 01 91 13	23 01 30.51 23 05 00 23 05 05 23 05 07 23 05 17 23 05 43 23 05 93 23 07 13 23 07 19 23 08 00 23 09 13 23 21 13 23 31 00 23 33 00 23 37 00 23 72 26 23 81 29	

Name	Sections		Stamp
Arthur Stokes, PE License No. 34736	26 05 00 26 05 05 26 05 19 26 05 26 26 05 29 26 05 33 26 05 43 26 05 53 26 05 73 26 08 00 26 09 23 26 22 00 26 24 13 26 24 16 26 27 26 26 28 16.16 26 43 00 26 51 00	27 05 00 27 05 33.13 27 10 00	
Nathanael Palmatier, PE License No. 44806		40 61 13 40 61 98 40 67 13 40 70 13	

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**INVITATION TO BID
FORMAL BID KC-2026-006**

**KITSAP COUNTY PUBLIC WORKS SEWER UTILITY DIVISION
Central Kitsap Treatment Plant HVAC Upgrades**

BID SUBMISSION DATE & TIME

February 26, 2026 @ 2:00 p.m.

SUBMISSION VIA USPS DELIVERY:

Kitsap County Purchasing Office

Attn: Glen McNeill, Purchasing Agent

614 Division Street MS-7

Port Orchard, Washington 98366

SUBMISSION VIA COURIER OR HAND DELIVERY

Kitsap County Administration Building

Purchasing Office, 4th Floor

Attn: Glen McNeill, Purchasing Agent

619 Division Street

Port Orchard, Washington 98366

BID OPENING TIME & LOCATION February 26, 2026 @ 2:00 p.m.

Kitsap County Administration Building
Commissioners Chambers, 3rd Floor
619 Division Street
Port Orchard, Washington 98366

MANDATORY PRE-BID MEETING February 12, 2026 @ 10:00 a.m.

Kitsap County
Central Kitsap Wastewater Treatment Plant
12351 Brownsville Hwy NE
Poulsbo, Washington 98370

COUNTY ESTIMATE: \$1,200,000

The Kitsap County Board of Commissioners will receive sealed bids for the construction of the **Central Kitsap Treatment Plant HVAC Upgrades** until the time and date indicated above. Bids will be received, publicly opened and read aloud at the locations described above. Instructions for the delivery of bids are contained in ‘Instructions to Bidders’ contained herein. Prospective Bidders are hereby notified that they are solely responsible for ensuring timely delivery of their bid to the Kitsap County Purchasing Office on or before the bid submission date and time indicated above.

The principal items or elements of construction at the CKTP complex include:

- Replacement of a portion of the HVAC system in the Lab/Admin Building, along with various architectural repairs
- Repair of a portion of the HVAC system in the Sludge Process Building
- Replacement of a rooftop Air Conditioning Unit at the Headworks Building.

A mandatory pre-bid meeting will be held at the Central Kitsap Wastewater Treatment Plant to include a tour of the buildings listed above. This will be the only tour of the site and facilities.

Bid documents may be found at <https://www.kitsap.gov/das/Pages/Online-Bids.aspx> . Questions regarding the bid process, contract terms and conditions, or how to obtain copies of the bid documents shall be directed to Glen McNeill at 360-337-4789, or by email to purchasing@kitsap.gov.

Technical questions about the work covered by the bid documents shall be directed to Brian Stewart, Construction Manager, at 360-271-5349 or email to rbstewart@kitsap.gov.

Kitsap County reserves the right to reject any or all bids and to waive informalities or irregularities. Bids received after the time set for submission of bids will not be considered.

Each bid proposal shall be completely sealed in a separate envelope, properly addressed as stated above, with the name and address of the bidder and the name of the project plainly written on the outside of the envelope. All bids shall be accompanied by:

- County Bid Proposal – as published in Invitation to Bid
- Signed acknowledgment of receipt of all addenda
- Surety company Bid Bond on an approved form, certified check, or cashier's check payable to Kitsap County in an amount not less than five percent (5%) of the basic Bid
- Subcontractor's List
- Bidder Information
- Bidder Responsibility Checklist
- Non-Collusion Affidavit
- Certification of Compliance with Wage Payment Statutes

Should the successful bidder fail to enter such contract in accordance with the Bid and furnish all documents and bonds required within the time frames stated in the specifications, the bid proposal deposit or bond shall be forfeited to Kitsap County.

Bids are likely to be rejected if the lowest, responsible, responsive Bid received exceeds the County's estimate by an unreasonable amount.

In addition to the Bid Proposal and Accompanying Documents, the two lowest bidders (and other bidders as requested) must submit the following documentation to the Contracting Agency within **48 hours** of the bid submittal deadline:

1. Documented information from the Washington State Secretary of State's Office, the Department of Revenue, or the Department of Labor and Industries providing the date of incorporation or formation, the state of incorporation or formation, that the bidder is active and in good standing

in the State of Washington, State of Washington tax reporting number, and the name and address of the registered agent, general partner, or managing member.

2. List of projects of similar size and scope.
3. Subcontractor Responsibility Checklist for each subcontractor identified in Bidder's Subcontractors List.
4. Project Superintendent Qualifications

Kitsap County hereby notifies all bidders that it will affirmatively ensure that in any contract entered pursuant to the advertisement, Women and Minority 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, sex, or national origin in consideration for an award.

Minority Business Enterprises will be required to meet all requirements of law as related to Public Works contracts, including the provision of the Equal Employment Opportunity and Affirmative Action Plan on the same basis as any other bidder.

In the interest of assuring the most expeditious and properly controlled project, it is a condition of this contract that the Prime Bidder must accomplish not less than 30% of the work to be done with his own forces. This shall in no way prohibit the use of rental equipment by the Prime Contractor's forces.

All contractors must be licensed in the State of Washington to conduct business.

Bidders are encouraged to review and understand the conditions, requirements and Contractor responsibilities of the project "Permits and Licenses" section in Section 00 70 00, PART 04.

BID PROPOSAL

TO: Kitsap County Board of Commissioners
614 Division Street
Port Orchard, WA 98366

Board of Commissioners:

The undersigned bidder agrees, if this bid is accepted, to enter a contract with the County, in the form included in the specifications to perform and furnish the work as specified or indicated in the bidding documents for the bid price and within the bid times indicated in this bid and in accordance with the other terms and conditions of the contract documents.

In submitting this bid, bidder represents, as more fully set forth in the contract, that:

1. This bid will remain subject to acceptance for 60 days after the day of bid opening. The Contracting Agency retains the right to request the apparent low bidder extend the award period or adjust their price accordingly. If an adjustment is requested, the Contracting Agency reserves the right to request the same adjustment from other bidders.
2. The Contracting Agency has the right to reject this bid.
3. Bidder will sign and submit the contract with the bonds and other documents required by the bidding requirements within 10 days after the date of Contracting Agency's Notice of Award.
4. Bidder has examined copies of all the bidding documents.
5. Bidder has made sufficient examination and has investigated and is satisfied as to the conditions to be encountered, the character, quantity, quality and scope of work, the quantities and qualities of materials to be supplied and equipment and labor to be used, and the requirements of the contract and proposal submitted, including all addenda for performance of the work.
6. Bidder is familiar with the existing conditions, access, staging and site limitations, and has made allowances for those conditions in their bid.
7. Bidder is familiar with all federal, state, and local laws, ordinances, and regulations, which in any manner might affect those engaged or employed in the work, the materials, equipment, or procedures used in the work, or which in any other way, might affect the conduct of the work. The Bidder is assumed to be familiar with such laws and regulations, and no plea of misunderstanding

or ignorance of the law will be considered.

8. Bidder has correlated the information known to bidder, information and observations obtained from visits to the site, reports and drawings identified in the bidding documents and additional examinations, investigations, explorations, tests, studies, and data with the bidding documents.
9. Bidder agrees that the work will be completed within the time established in the Contract Document from the date of Notice to Proceed.
10. The bidder has determined from careful examination the methods; materials, labor and equipment required to perform the work in full and shall reflect the same in their bid price. If, during the performance of the work, methods, materials, labor, or equipment required are beyond those anticipated by the bidder, the Bidder will not be entitled to additional compensation except as may be provided for elsewhere in these specifications.

ADDENDA:

Bidder has received the following addenda, receipt of which is hereby acknowledged:

Addendum No. _____, Dated: _____

Addendum No. _____, Dated: _____

Addendum No. _____, Dated: _____

SUMMARY OF BID DOCUMENTATION:

It is mandatory that each bidder complete and submit with its bid, documentation required by the contract documents, including, but not limited to the following:

1. Bid Proposal (signed, with bid amount, and acknowledgement of addenda)
2. Bid Guaranty Bond
3. Subcontractor's List
4. Bidder Information
5. Bidder Responsibility Checklist
6. Non-Collusion Affidavit Certificate
7. Certification of Compliance with Wage Payment Statutes
8. Schedule of Values

BASIC BID:

Pursuant to and in compliance with the advertisement for bids and other documents relating thereto, the undersigned Bidder hereby certifies having carefully examined contract documents entitled **Central Kitsap Treatment Plant HVAC Upgrades** as well as conditions affecting the work, and is familiar with the sites; and having made the necessary examinations, here proposes to furnish all labor, materials, equipment, and services necessary to complete the work in strict accordance with the above named documents for an amount computed upon the basis of the quantity of work actually performed at the Bid prices set forth herein.

PROPOSAL:

The Bidder certifies that the cost of all labor, equipment, plants, materials, including overhead and profit, necessary for proper completion of the work shall be included in the prices for the various bid items. All prices shall be legible and written in ink or typed. The proposal shall include a total lump sum base bid amount which includes a **\$100,000.00** Minor Change Allowance and 9.2% Washington State Sales Tax (WSST).

BID AMOUNT:

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the total lump sum base bid amount of: \$ _____ which includes a \$100,000 Minor Change Allowance and 9.2% Washington State Sales Tax (WSST).

BIDDER agrees to modify the above by \$ _____ should the COUNTY accept the alternate line item: Remove and Replace Skylight and all Associated Appurtenances (Option A)

SALES TAX:

All work identified in the bid schedule is subject to collection of Washington State sales tax on the Contract Price. Bidders should contact the Washington State Department of Revenue for further clarification of sales tax rules. If the project extends through a sales tax increase, the Contractor will be allowed a commensurate increase in the sales tax and adjustment in the contract amount. However, the Contracting Agency will not adjust payment if the Bidder bases a Bid on a misunderstood tax liability.

OPENING OF BIDS:

Bids received prior to the time of opening will be kept unopened and secured until the time of the bid opening as specified in the Advertisement for Bids. No bid received thereafter will be considered. No responsibility will attach, and bidders waive all complaints against the County for premature opening of an improperly addressed or identified bid.

At the time and place fixed for the opening of bids, every bid received within appropriate time will be opened and publicly read aloud.

The Contracting Agency reserves the right to postpone the date and time for receiving and/or opening of bids at any time prior to the date and time established in the Advertisement for Bid. Postponement notices shall be mailed to bidders in the form of addenda.

The Contracting Agency may reject all bids if they exceed budgeted cost or the Contracting Agency may negotiate bid pricing with the apparent low responsive bidder including changes in the contract plans and specifications, to bring the bid within budgeted cost.

CONTRACT AND BOND:

If notified of the acceptance of this bid within sixty (60) days of the time set for opening of bids, the undersigned agrees to execute a contract for the above work, for a compensation computed from the above-stated sums, on the Contract Form bound with the specifications and to furnish a bond as required by the specifications on the form bound therein.

BID GUARANTY:

It is agreed that if the undersigned fails to execute said Contract and furnish said Bond within ten (10) days after written notice of award of Contract, then the Bid Guaranty shall be retained by the County as liquidated damages. If this bid is not accepted within sixty (60) days after the time set for the opening of bids, or if the undersigned delivers said Contract and Bond in a timely manner, then the check or cash shall be returned, or the Bid Bond shall become void.

SIGNATURE

Signed By: _____ Date: _____

Please Print Name: _____ Title: _____

Name of Firm: _____

Address: _____

Telephone: (_____) _____

END OF BID PROPOSAL

BID GUARANTY BOND

IFB

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____, hereinafter called the Principal, and _____, hereinafter called the Surety, are jointly and severally held and firmly bound unto the Kitsap County Department of Public Works, hereinafter called the Obligee, each in the penal sum of five percent (5%) of the total amount of the Bid of the Principal for the work, this sum not to exceed _____ dollars (\$ _____) of lawful money of the United States for the payment thereof unto the Obligee, the Principal, and Surety jointly and severally bind themselves forever firmly by these presents.

WHEREAS, the Principal is herewith submitting its offer for the fulfillment of Obligee’s contract for construction of: **Central Kitsap Treatment Plant HVAC Upgrade.**

NOW, THEREFORE, the condition of this obligation is such that if the Principal is awarded the contract, and if the Principal, within the time specified in the bid for such contract, enters into, executes, and delivers to the Obligee an agreement in the form provided herein complete with evidences of insurance, and if the Principal within the time specified in the bid gives the Performance and Payment Bond on the form provided herein to the Obligee, then this obligation shall be void; otherwise, the Principal and Surety will pay unto the Obligee the difference in the money between the total amount of the Bid of the Principal and the amount for which the Obligee legally contracts with another party to fulfill the Contract if the latter amount be in excess of the former, but in no event shall the Surety’s liability exceed the penal sum hereof.

AND IT IS HEREBY DECLARED AND AGREED that the Surety shall be liable under this obligation as Principal, and that nothing of any kind or nature whatsoever that will not discharge the Principal shall operate as a discharge or a release of liability of the Surety.

IT IS HEREBY FURTHER DECLARED AND AGREED that this obligation shall be binding upon and inure to the benefit of the Principal, the Surety, and the Obligee and their respective heirs, executors, administrators, successors, and assigns.

SIGNED AND SEALED this day of _____, 2026.

Contractor's Corporate Seal

Principal

Signature for Principal

Title of Signatory

Surety's Corporate Seal

Surety

Signature for Surety

Title of Signatory

END OF BID GUARANTY BOND

SUBCONTRACTORS LIST

Each Bidder is advised of the requirements of Washington Law, RCW 39.30.060. Pursuant to Title 39 of the Revised Code of Washington, each bidder is required to submit as part of the bid or within one hour after the published bid submittal time, the names of the subcontractors with whom the bidder, if awarded the contract, will subcontract for performance of the work of heating, ventilation and air conditioning; plumbing as described in RCW 18.106 and electrical as described in RCW 19.28 or to name itself for the work. Additionally, each bidder is required to submit as part of the bid or within 48 hours after the published bid submittal time, the names of the subcontractors with whom the bidder, if awarded the contract, will subcontract for performance of the work of structural steel and rebar. 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. Failure of the bidder to submit the names of such subcontractors or to name itself to perform such work or the naming of two or more subcontractors to perform the same work shall render the bidder's bid non-responsive and, therefore, void.

List subcontractors appropriately

HEATING, VENTILATION AND AIR CONDITIONING

Subcontractor Name: _____

PLUMBING

Subcontractor Name: _____

ELECTRICAL

Subcontractor Name: _____

OTHER SUBCONTRACTORS (whose work is equal to or greater than 10% of the bid)

(Note: This is required by this contract and not RCW 39.30.060)

**[THIS FORM SHALL BE COMPLETED IN FULL AND
SUBMITTED WITH THE BID PROPOSAL**

END OF SUBCONTRACTORS LIST

BIDDER INFORMATION

Contracting Firm Name:
Number of Years Contractor has been in the construction business under its present firm name:
Present gross dollar amount of work under contract:
Present gross dollar amount remaining to be completed of work under contract:
General type of work performed by firm:

List the five major pieces of equipment to be used on this project:	Owned	Leased	Rented
1.			
2.			
3.			
4.			
5.			

List the name of the Project Manager and Superintendent responsible for this project	# of Years with Firm
Name of Project Manager:	
Name of Superintendent:	

Bank Reference:
Have you changed bonding companies within the last three years?
If so, why? (Optional)

BID PROPOSAL – ACCOMPANYING DOCUMENTATION

Have you ever been sued by the client or have you ever sued the client on any public works contract for a special purpose district, municipality, county, or state government? _____

For what reason? _____

Disposition of case, if settled: _____

Do you have any outstanding payments due to the Department of Revenue? _____

If yes, describe the plan to address those payments _____

Bidder agrees that the County shall retain the right to obtain all credit reports.

() _____

Yes Signature

In the last 5 years, has the Bidder had a three-year average Experience Modification Rate (EMR) no greater than 1.1 (Include EMR documentation)?

() _____

Yes/No Signature

Does the Bidder have sufficient bonding capacity?

() _____

Yes/No Signature

The Bidder shall include with their Bid a notarized statement from an admitted and Washington State approved surety insurer, which states that Bidder’s current bonding capacity is sufficient for this project.

In the last five (5) years, has the Bidder had their contractor’s license revoked?

() _____

Yes/No Signature

In the last five (5) years, has the Bidder been “defaulted” or “terminated” by an owner (other than for convenience of the owner)?

() _____

Yes/No Signature

In the last five (5) years, has the Bidder been convicted of a crime involving the awarding of a contract of a government (local, state, or federal) construction project or the bidding or performance of a government construction contract?

() _____

Yes/No Signature

In the last five (5) years, has the Bidder been found guilty in a criminal action, for making any false claim or material misrepresentations to any public agency or entity?

() _____

Yes/No Signature

In the last five (5) years, has the Bidder been convicted of a crime involving any federal, state or local law related to construction, including acts of dishonesty?

() _____

Yes/No Signature

[THIS FORM SHALL BE COMPLETED IN FULL AND SUBMITTED WITH THE BID PROPOSAL]

BIDDER RESPONSIBILITY CHECKLIST

The following checklist will be used to document that the Bidder meets the bidder responsibility criteria. Please print a copy of documentation from the appropriate website to be included with the submittal.

General Information	
Project Name:	Formal Bid Contract Number:
Bidder's Business Name:	Bid Submittal Deadline:
Contractor Registration	
License Number:	Status:
Effective Date (must be effective on or before Bid Submittal Deadline):	Expiration Date:
Contractor Infraction List	
Is Bidder on Infraction List? Yes <input type="checkbox"/> No <input type="checkbox"/>	
Current UBI Number	
UBI Number:	Account Status: Open <input type="checkbox"/> Closed <input type="checkbox"/>
Industrial Insurance Coverage	
Account Number:	Account Current: Yes <input type="checkbox"/> No <input type="checkbox"/>
Employment Security Department Number	
Employment Security Department Number:	
Provide a copy of latest correspondence containing bidder's account number with Employment Security Department. Do not provide document containing personal information such as social security numbers.	
State Excise Tax Registration Number	
Tax Registration Number:	Account Status: Open <input type="checkbox"/> Closed <input type="checkbox"/>
Not Disqualified from Bidding	
Has the Bidder been listed on the "Contractors Not Allowed to Bid" list of the Department of Labor and Industries in the last two (2) years? Yes <input type="checkbox"/> No <input type="checkbox"/>	
Bankruptcy	
Has the Bidder declared Bankruptcy in the last five (5) years? Yes <input type="checkbox"/> No <input type="checkbox"/>	
Information Supplied by:	
Print Name of Bidder Representative:	Date:

[THIS FORM SHALL BE COMPLETED IN FULL AND SUBMITTED WITH THE BID PROPOSAL]

Schedule of Values

Bidders shall fill out the following schedule of values as described in Section 01 20 00 for submission with the bid proposal. The contract will be awarded based on the lowest, responsive Lump Sum Base Bid Amount. This schedule will be used to determine if a particular bidder is responsive. Where specific work is not identified by a given line item, Contractor shall include such Work in the line item most closely associated with the specific Work. Schedule of Value amounts must add up to the Lump Sum Base Bid written by the Contractor on the Bidder’s Proposal. This schedule should only reflect the base bid amounts. Bid items not filled in will be considered non-responsive.

The Add/Deduct line item should **not** be included in the Lump Sum Bid amount. The County will evaluate whether to accept this line item after bid opening.

General Conditions

1	<p>Mobilization/Demobilization (max 5% of Total Lump Sum Base Bid)</p> <ul style="list-style-type: none"> - Costs associated with physical mobilization and demobilization to and from the construction site. Payment shall be 50% at the time contractor mobilizes equipment on-site at the start of the construction phase and the remaining 50% at physical completion and acceptance of the project. 	\$ _____
2	<p>General Conditions (max 12% of Total Lump Sum Base Bid)</p> <ul style="list-style-type: none"> - Costs associated with insurance, bonds, overhead, pre-construction tasks, temporary facilities, work progress, cleanup and restoration, and final completion and acceptance of the project. Payment shall be 20% at the start of the pre-construction phase, 50% at start of the construction phase, and the remaining 30% paid at project completion. 	\$ _____
3	<p>O&M Manuals and As-Built/Record Drawings (30% paid at startup up of Lab 102, remainder at project completion)</p> <ul style="list-style-type: none"> - Costs associated with preparation of all O&M manuals and as-built record drawings until acceptance by the Construction Manager. 	\$ _____
4	<p>Testing, Startup, and Commissioning of HVAC (30% paid at acceptance of Lab 102, 30% paid at acceptance of Lab 101, 15% paid at acceptance of Headworks, 15% paid at acceptance of the Process Building, and remainder at project completion)</p> <ul style="list-style-type: none"> - Costs associated with the testing, start-up, and commissioning of all HVAC units. 	\$ _____
5	<p>Minor Change Allowance</p> <ul style="list-style-type: none"> - As described in Section 00 70 00, this item is reserved as a construction contingency for “Minor Changes” which may occur during the work with written approval by the Construction Manager. This budget 	\$ 100,000

BID PROPOSAL – ACCOMPANYING DOCUMENTATION

	allowance will facilitate minor additional work without the need for a Contract amendment. Payment will be made upon completion and acceptance of each Minor Change’.	
	Subtotal General Conditions	

Lab Building

6	Remove and Replace Aluminum Framed Windows	\$
7	Remove and Replace Exterior Double Metal Door (with windows)	\$
8	Remove and Replace Exterior Double Metal Door (without windows) and Frame	\$
9	Remove and Replace Acoustic Ceiling (2' x 2')	\$
10	Install New Acoustic Ceiling (2'x2')	\$
11	Remove and Replace Skylight and all Associated appurtenances (Option B)	\$
12	Install New EVR 1 and all Associated Duct Work, Housekeeping Pad, and Penetrations	\$
13	Remove Existing HRU and all Associated Duct Work	\$
14	Install EVR 2 and all Associated Duct Work, Housekeeping Pad, and Penetrations	\$
15	Install New EVR 3 and all Associated Duct Work, Supports, and Penetrations	\$
16	Install New EVR 4 and all Associated Duct Work, Supports, and Penetrations	\$
17	Remove Existing Mini Split Systems and Return to Owner	\$
18	Relocate Muffle Furnace Exhaust Vent Piping	\$
19	Install SS 3,4,5 and CU3 and all Associated Pipe and Duct Work and Housekeeping Pad	\$
20	Install FCU1 and CU4 and all Associated Pipe and Duct Work and Housekeeping Pad	\$
21	Install FCU2 and CU5 and all Associated Pipe and Duct Work and Housekeeping Pad	\$
22	Install DX1 and CU1 and all Associated Pipe and Duct Work and Housekeeping Pad	\$
23	Install New Intake and Exhaust Plenum Duct Box and Louvers, and Grill	\$

BID PROPOSAL – ACCOMPANYING DOCUMENTATION

24	Install all Required Electrical Equipment and Wiring to EVR 1	\$
25	Remove Existing HRU Electrical Components	\$
26	Install all Required Electrical Equipment and Wiring to EVR 2	\$
27	Install all Required Electrical Equipment and Wiring to EVR 3	\$
28	Install all Required Electrical Equipment and Wiring to EVR 4	\$
29	Remove Existing Electrical Components to Existing Mini Split Systems	\$
30	Install all Required Electrical Equipment and Wiring to SS 3,4,5 and CU3	\$
31	Install all Required Electrical Equipment and Wiring to FCU1 and CU4	\$
32	Install all Required Electrical Equipment and Wiring to FCU2 and CU5	\$
33	Install all Required Electrical Equipment and Wiring to DX1 and CU1	\$
34	Install Electrical Panel D and all Associated Conduit and Wiring	\$
35	Electrical Demo as Shown on Plans (including Light Fixtures, Circuits, Disconnects, etc.)	\$
36	Misc Demo (Including Cabinet Heaters, Roof Penetrations Water Piping, Lights etc.)	\$
37	Install New Light Fixtures	\$
Subtotal Lab Bldg		\$

Process Building

39	Install Sensors on Existing HVAC Units in Process Building	\$
40	Install Dampers, Actuators, and Control Valves	\$
41	Install new PLC Controller and Associated appurtenances and Wiring	\$
Subtotal Process Bldg		\$

Head Works Building

42	Remove and Replace RTU and all Associated appurtenances	\$
	Subtotal Head Works Building	\$

	Total Washington State Sales Tax (WSST) @ 9.2%	\$
	Total Lump Sum Base Bid	\$

Add/Deduct Alternate

	Remove and Replace Skylight and all Associated Appurtenances (Option A)	\$
	Washington State Sales Tax (WSST) @ 9.2%	\$
	Total Add/Deduct Alternate	\$

SUBCONTRACTOR RESPONSIBILITY CHECKLIST

The following checklist will be used to document that the Bidder meets the mandatory bidder responsibility criteria. Please print a copy of documentation from the appropriate website to be included with the submittal.

General Information	
Project Name:	Formal Bid Contact Number:
Subcontractor's Business Name:	Bid Submittal Deadline:
Contractor Registration	
License Number:	Status:
Effective Date (must be effective on or before Subcontract Bid Submittal Deadline):	Expiration Date:
Contractor Infraction List	
Is Subcontractor on Infraction List?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Current UBI Number	
UBI Number:	Account Status: Open <input type="checkbox"/> Closed <input type="checkbox"/>
Industrial Insurance Coverage	
Account Number:	Account Current: Yes <input type="checkbox"/> No <input type="checkbox"/>
Employment Security Department Number	
Employment Security Department Number:	
Please provide a copy of latest correspondence containing subcontractor's account number with Employment Security Department. Do not provide document containing personal information such as social security numbers.	
State Excise Tax Registration Number	
Tax Registration Number:	Account Status: Open <input type="checkbox"/> Closed <input type="checkbox"/>
Not Disqualified from Bidding	
Is the Subcontractor listed on the "Contractors Not Allowed to Bid" list of the Department of Labor and Industries?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Contractor Licenses	
<u>Electrical</u> : If required by Chapter 19.28 RCW, does the Subcontractor have an Electrical Contractor's License? Yes <input type="checkbox"/> No <input type="checkbox"/>	<u>Elevator</u> : If required by Chapter 70.87 RCW, does the Subcontractor have an Elevator Contractor's License? Yes <input type="checkbox"/> No <input type="checkbox"/>
Checked by:	
Name of Employee:	Date:

[This form(s) shall be completed in full and submitted within 48 hours of the bid submittal deadline by the two lowest bidders and other bidders as requested by the Contracting Agency.]

PROJECT REFERENCES

Using the following form (use additional forms as needed), the Bidder shall describe projects that meet similar size and scope criteria.

Project Name: _____

Project Manager: _____ Project Superintendent: _____

Public Agency Name: _____

Contact Person: _____ Phone No: _____

Awarded Contract Amount: _____ Final Contract Amount: _____

Project Start Date: _____ Project Completion Date: _____

Project Location: _____

Project Scope: _____

Claims, if any, filed by the Contractor and the basis for the claims: _____

PROJECT SUPERINTENDENT

The undersigned hereby designates the following individual to serve as the Project Superintendent representing the Contractor for this Project. The qualifications of this individual are provided below (attach additional sheets if necessary).

This individual shall be present on-site during all construction activities and shall have full authority to act and speak on behalf of the Contractor. The designated Project Superintendent shall not be removed from this Project, nor temporarily substituted, without the prior written consent of the Construction Manager.

Project Superintendent’s Name: _____

Years of Experience: _____

Brief but Complete Description of Experience Relevant to this Project: _____

References from Owners where work of similar scope and complexity has been accomplished under Proposed Superintendent’s direct supervision.

1. _____	2. _____	3. _____	4. _____	5. _____
(Name)	(Name)	(Name)	(Name)	(Name)
_____	_____	_____	_____	_____
(Company)	(Company)	(Company)	(Company)	(Company)
_____	_____	_____	_____	_____
(Address)	(Address)	(Address)	(Address)	(Address)
_____	_____	_____	_____	_____
(Phone)	(Phone)	(Phone)	(Phone)	(Phone)

“I consent to the disclosure of my qualifications and other applicable personal data for the purpose of evaluating proposals under this solicitation.”

Employee’s Signature

Date

“I certify to this employee’s role in this Project and that the qualifications presented herein are accurate, complete and current.”

Bidder: _____ Date: _____

Signed: _____ Title: _____

[This form(s) shall be completed in full and submitted within 48 hours of the bid submittal deadline by the two lowest bidders and other bidders as requested by the Contracting Agency.]

END OF BIDDER INFORMATION

BIDDER'S CHECKLIST

NOTE: The purpose of this checklist is to serve as a reminder of major items to be addressed in submitting a bid and by the Successful Bidder after notification of award and is not intended to be all-inclusive. It does not alleviate the Bidder from the responsibility of becoming familiar with all aspects of the contract documents and proper completion and submission of the Bid.

<p>1. Contract Documents (including asbestos survey report thoroughly read and understood.</p>	
<p>2. Attend pre-bid conference.</p>	
<p>3. All blank spaces in proposal filled in, preferably in black ink.</p>	
<p>4. Receipt of all addenda acknowledged.</p>	
<p>5. Bid Form and other documents are signed by authorized officer.</p>	
<p>6. Prices computed and presented correctly.</p>	
<p>7. Subcontractors are named as indicated in the Contract Documents.</p>	
<p>8. The following documents, to be submitted with the bid, completed, signed, and dated as applicable.</p> <ul style="list-style-type: none"> a. Bid Proposal b. Bid Guaranty Bond c. Subcontractors List d. Bidder Information e. Bidder Responsibility Checklist f. Non-Collusion Affidavit Certificate g. Certification of Compliance with Wage Payment Statutes h. Schedule of Values 	
<p>9. Bid documents are submitted in sealed envelope and properly labeled.</p>	
<p>The following documents shall be executed upon request within 48 hours of bid opening:</p> <ul style="list-style-type: none"> 1. Subcontractor Responsibility Checklist for each subcontractor in Bidder's Subcontractors List 2. Project References (similar size and scope) 3. Project Superintendent Qualifications 	
<p>The following documents shall be executed and complied with after the contract is awarded:</p> <ul style="list-style-type: none"> a. Capital Projects Contract Agreement b. Performance and Payment Bonds c. Insurance Certificates 	

END OF BIDDER'S CHECKLIST

INSTRUCTIONS TO BIDDERS

1.01 Invitation to Bid

The Invitation to Bid bound herewith is incorporated by this reference as a part of these Instructions, including the following:

1.02 Bidder Responsibility

It is the intent of the Contracting Agency to award a contract to the lowest responsive, and responsible bidder. Before award, the bidder must meet the following bidder responsibility criteria to be considered a responsible bidder. The bidder will be required by the Contracting Agency to submit documentation demonstrating compliance with the criteria. The bidder must:

1. Have a current certificate of registration as a contractor in compliance with Chapter 18.27 RCW at the time of bid submittal.
2. Have a current Washington Unified Business identifier (UBI) number.
3. If applicable, have:
 - a. Industrial insurance coverage for the bidder's employees working in Washington as required in Title 51 RCW.
 - b. Washington Employment Security Department number per Title 50 RCW;
 - c. A Washington Department of Revenue state excise tax registration number as required in Title 82 RCW;
4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3).
5. Have current bonding capacity adequate for this project.
6. Not have filed for bankruptcy in the last five (5) years.
7. Not have had their contractor's license revoked in the last five (5) years.

1.02.1 Subcontractor Responsibility.

The Contractor shall include the responsibility criteria 1 through 4 of the previous section in each of its first-tier subcontracts and shall require each of its subcontracts to include the same language in each of their subcontracts. Upon request of the Contracting Agency, the Contractor shall promptly provide documentation to the Contracting Agency demonstrating that the subcontractor meets the responsibility criteria. The requirements of this section apply to all subcontractors regardless of tier.

1.02.2 Supplemental Bidder Responsibility Criteria

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

1. Bidder shall not be "inactive" or "not in good standing" with the Washington State Secretary of State's Office, the Department of Revenue, or the Department of Labor and Industries.
2. Bidder shall have been in business as a General, HVAC, or Electrical contractor under its present name for a minimum of two (2) years;
3. Bidder shall not have been disqualified from entering a construction contract by another governmental agency in the last two (2) years;
4. Bidder shall not have declared bankruptcy or been in receivership in the last five (5) years;
5. Bidder, Bidder's designated project manager, and Bidder's designated superintendent/foreman for this project shall each have successfully completed at least three (3) projects of a similar size and scope as required by the Contract Documents for this project within the last ten (10) years. In evaluating whether the projects were "successfully completed," the Contracting Agency may check references for the previous projects and may evaluate the bidder's performance including but not limited to, the following areas:
 - a. Quality control;
 - b. Safety record;
 - c. Timeliness of performance;
 - d. Use of skilled personnel, including subcontractors;
 - e. Management of subcontractors;
 - f. Availability of and use of appropriate equipment;
 - g. Compliance with contract documents;
 - h. Management of submittals process, change orders and closeout.
6. Bidder shall not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.

For purposes of meeting this criterion, the Contracting Agency has determined that "similar size and scope" means municipal public works projects that include HVAC or electrical upgrades in a commercial or public building. Separate projects may be used to demonstrate compliance with these installation requirements. Each project shall also have a construction cost of more than \$200,000.

1.03 Documentation

As evidence the bidder meets the responsibility criteria above, the Bidder shall complete and submit the Bidder Responsibility Checklist as part of the Bidder's Bid Proposal.

In addition, the two lowest bidders must submit the following documentation for each referenced project to the Contracting Agency within 48 hours of the bid submittal deadline. The Contracting Agency reserves the right to request such documentation from other bidders. In the event a bidder refuses to provide the requested information or fails to provide the requested information within the time periods specified in the Bid Documents, then the Contracting Agency may find the bidder non-responsible.

1. Documented information from the Washington State Secretary of State's Office, the Department of Revenue, or the Department of Labor and Industries providing the date of incorporation or formation, the state of incorporation or formation, that the bidder is active and in good standing in the State of Washington, State of Washington tax reporting number, and the name and address of the registered agent, general partner, or managing member.
2. List of projects of similar size and scope. This list shall include the following for each project:
 - a. Project Name.
 - b. Project Manager's Name and Project Superintendent's Name.
 - c. Project owner's name and contact information for the project owner's representative.
 - d. Awarded contract amount.
 - e. Final contract amount.
 - f. Project start and completion date.
 - g. Location of the project.
 - h. A description of the scope of the project and how the project is like this project. The description should include but not be limited to the pump size and capacity, the site work that was required, the ground conditions encountered, and other information relevant to the successful completion of the referenced project.
 - i. Claims (either resolved or unresolved) filed by the Contractor and basis for the claims.
3. Subcontractor Responsibility Checklist, provide for each subcontractor identified in Bidder's Subcontractors List.

The basis for evaluation of Bidder compliance with these supplemental criteria shall be any documents or facts obtained by the Contracting Agency (whether from the Bidder or third parties) which any reasonable owner would rely on for determining such compliance, including but not limited to:

1. Financial, historical, or operational data from the Bidder.
2. Information obtained directly by the Contracting Agency from owners for whom the Bidder has worked, or other public agencies or private enterprises.
3. Any additional information obtained by the Contracting Agency which is believed to be relevant to the matter.

1.04 Appeals

If the Contracting Agency determines the bidder does not meet the bidder responsibility above and is therefore not a responsible bidder, the Contracting Agency 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 24 hours of receipt of the Contracting Agency's determination by presenting additional information to the Contracting Agency. The Contracting Agency will consider the additional information before issuing its final determination. If the final determination affirms that that bidder is not responsible, the Contracting Agency will not execute a contract with any other bidder until two (2) business days after the bidder determined to be not responsible has received the final determination. For purposes of this section, the date of the Contracting Agency's transmission of the Contracting Agency's determination(s) by facsimile or electronic mail to the bidder at the facsimile number or email address provided by the bidder in its bid shall constitute the date of receipt by the bidder of the written notices provided for herein.

1.05 Other Conditions

If two or more prospective bidders desire to bid jointly as a Joint Venture on a single contract, each must be deemed qualified, as provided above, and they must also include with the bid proposal packet an agreement to Joint Venture. The Joint Venture is then treated as a new firm and qualified as such. The Joint Venture and any of its members are subject to the conditions as stated elsewhere within these specifications. Any agreement to Joint Venture shall be signed by each of the bidders and must specify everyone who is authorized to execute proposals, contracts, bond, and other documents on behalf of the Joint Venture. If any of the bidders is a corporation, the agreement must be accompanied by a resolution of the corporation authorizing such Joint Venture agreement and designating the officer(s) authorized to sign such Joint Venture agreement or contract on behalf of such corporation.

In the interest of assuring the most expeditious and properly controlled project, it is a condition of this contract that the Prime Bidder must accomplish not less than 30% of the work to be done with his own forces. This shall in no way prohibit the use of rental equipment by the Prime Contractor's forces. All equipment and personnel shall be subject to approval of the Owner.

1.06 Addenda

Where appropriate, responses to questions, inquiries or requests for additional information or for substitution of proposed material will be issued in the form of Addenda, and copies of each addendum will be issued to all prospective bidders of record. Additionally, addenda are on file at the Kitsap County Purchasing Office. During the bidding period, prospective bidders will be advised by Addendum of additions to, deletions from or changes in the requirements of the contract documents.

Kitsap County will not be responsible for the authenticity or correctness of oral interpretations of contract documents or for information obtained in any other manner than through the media of Addenda. Bidders shall acknowledge receipt of Addendum in their bid proposals and each Addendum shall be considered a part of the Contract Documents. Failure to acknowledge receipt of any Addenda issued will invalidate a proposal as incomplete.

Should a bidder have a Request for Clarification or find discrepancies, ambiguities or omissions in the drawings or specifications, or should a bidder be in doubt as to their meaning, bidder shall at once notify Brian Stewart, Construction Manager, (360) 271-5349 or email rbstewart@kitsap.gov. If appropriate, the Contracting Agency will send a written instruction to all bidders in the form of an Addendum. Neither the Contracting Agency nor the Construction Manager may be held responsible for any oral instruction. Questions received by the Contracting Agency less than seventy-two (72) hours before bids close may not be answered. All addenda issued prior to the time of bid closing are incorporated into the contract.

Interpretations, corrections, and changes of the Bidding documents will be made by addendum only through the Kitsap County Purchasing Office. Interpretations, corrections, and changes in the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

Any variances to the contract documents shall not be accepted unless agreed to by the County in writing. Substitutions will not be considered until after award of contract.

1.07 Plans and Specifications

Information as to where Bid Documents can be obtained or reviewed will be found in the Invitation to Bid for the work.

After award of the contract, conformed plans and specifications will be issued to the Contractor at no cost as detailed below:

To Prime Contractor	No. of Sets	Basis of Distribution
Reduced plans (11" x 17")	2	Furnished automatically with the limited NTP
Standard plans (22" x 34")	3	Furnished automatically with the limited NTP
Contract Provisions	3	Furnished automatically with the limited NTP

Of these provided sets, one official set must be always maintained on the job site available for review by Contractor and County staff.

1.08 Proposal Forms

The Proposal Form will identify the project and its location and describe the work. It will also list estimated quantities, units of measurement, the items of work, and the materials to be furnished at the unit bid prices. The bidder shall complete spaces on the proposal form that call for, but are not limited to, the total bid amount; price of alternatives; signatures; date; and, where applicable, retail sales taxes and acknowledgment of addenda; the bidder's name, address, telephone number, and signature; the bidder's DBE commitment, if applicable; a State of Washington Contractor's Registration Number; and a Business License Number, if applicable. Bids shall be in legible figures (not words) written in ink or typed and expressed in U.S. dollars. The required certifications are included as part of the Proposal Form.

The Contracting Agency reserves the right to arrange the proposal forms with alternates and additives, if such be to the advantage of the Contracting Agency. The bidder shall bid on all alternates and additives set forth in the Proposal Form unless otherwise specified.

The form of the Bid Proposal shall not be altered by interlineations, erasures, or by any other method whatsoever.

1.09 Preparation of Proposal

The Contracting Agency will accept only those Proposals properly executed on the physical forms it provides, or electronic forms that the Bidder has been authorized to access. Unless it approves in writing, the Contracting Agency will not accept Proposals on forms attached to the Plans and stamped "Informational".

All prices shall be in legible figures (not words) written in ink or typed and expressed in U.S. dollars and cents. The Proposal shall include the total Contract price (omitting digits more than two places to the right of the decimal point).

In the space provided on the signature sheet, the Bidder shall confirm that all Addenda have been received.

The Bidder shall submit with the Bid a list of:

1. Subcontractors who will perform the work of structural steel installation, rebar installation, heating, ventilation, air conditioning, and plumbing as described in RCW 18.106 and electrical as described in RCW 19.28, and
2. The Work those subcontractors will perform on the Contract as described in RCW 39.30.060.
3. Shall not list more than one subcontractor for each category of work identified, except, when subcontractors vary with Bid alternates, in which case the Bidder shall identify which subcontractor will be used for which alternate.

If no subcontractor is listed, the Bidder acknowledges that it does not intend to use any subcontractor to perform those items of work.

The Bidder shall submit with their Bid a completed Contractor Certification Wage Law Compliance form, provided by the Contracting Agency. Failure to return this certification as part of the Bid Proposal package will make this Bid Nonresponsive and ineligible for Award. A Contractor Certification of Wage Law Compliance form is included in the Proposal Forms.

The Bidder shall make no stipulation on the Bid Form, nor qualify the bid in any manner.

A bid by a corporation shall be executed in the corporate name, by the president or a vice president (or other corporate officer accompanied by evidence of authority to sign).

A bid by a partnership shall be executed in the partnership name and signed by a partner.

A bid by a joint venture shall be executed in the joint venture name and signed by a member of the joint venture.

1.10 Bid Deposit

A deposit of at least 5 percent of the total Bid shall accompany each Bid. This deposit may be cash, certified check, cashier's check, or a proposal bond (Surety bond). A proposal bond shall not be conditioned in any way to modify the minimum 5 percent required. The Surety shall: (1) be registered with the Washington State Insurance Commissioner, and (2) appear on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner.

The failure to furnish a Bid deposit of a minimum of 5 percent with the Bid or as a physical supplement to the electronic Proposal Form shall make the Bid nonresponsive and shall cause the Bid to be rejected by the Contracting Agency.

Bid bonds shall contain the following:

1. Contracting Agency-assigned number for the project;
2. Name of the project;
3. The Contracting Agency named as obligee;
4. The amount of the bid bond stated either as a dollar figure or as a percentage which represents five percent of the maximum bid amount that could be awarded;
5. Signature of the bidder's officer empowered to sign official statements. The signature of the person authorized to submit the bid should agree with the signature on the bond, and the title of the person must accompany the said signature;
6. The signature of the surety's officer empowered to sign the bond and the power of attorney.

Bid bonds shall be issued by a surety company licensed to do business in the State of Washington. Bidder shall use the bond form included in the Contract Provisions.

Bid bonds and checks will be returned to all except the two lowest bidders within ten (10) days after the bid award. Bid bonds or checks of each of the two lowest bidders will be returned within three (3) days after execution of the Contract, and after the Contract has been executed and approved by Kitsap County.

1.11 Noncollusion Declaration

A declaration shall be provided certifying that the Bidder has not taken part in collusion or other action that would restrain competitive Bidding.

The Code of Federal Regulations 23 CFR 635.112(f)(1) requires that: "Each Bidder shall file a sworn or unsworn statement executed by, or on behalf of the person, firm, association, or corporation submitting the Bid, certifying that such persons, firm, association, or corporation has not either directly or indirectly, entered into any agreement, participated in collusion, or otherwise taken action in restraint of free competitive Bidding in connection with the submitted Bid. Failure to submit the sworn or unsworn statement as part of the Bid Proposal package will make the Bid nonresponsive and not eligible for Award consideration". In addition, 23 CFR 635.112(f)(1) requires that the Contracting Agency provide the form for the declaration to prospective Bidders and that the declaration shall be executed by such persons, firm, association, or corporation under penalty of perjury under the laws of the United States. Therefore, by including the Non-collusion Declaration as part of the signed bid Proposal, the Bidder is deemed to have certified and agreed to the requirements of the Declaration

1.12 Delivery of Proposal

Each Bid Proposal shall be submitted in a sealed envelope, with the Project Name and Formal Bid Contract Number as stated in the Invitation to Bid clearly marked on the outside of the envelope, or as otherwise stated in the Bid Documents, to ensure proper handling and delivery.

The Contracting Agency will not open or consider any Bid Proposal that is received after the time specified in the Invitation to Bid for receipt of Bid Proposals or received in a location other than that specified in the Call for Bids.

Proposals that are received as required will be publicly opened and read as specified in these instructions. The Contracting Agency will not open or consider a Proposal when the Proposal or Bid deposit is received after the time specified for receipt of Proposals or received in a location other than that specified for receipt of Proposals unless an emergency or unanticipated event interrupts normal work processes of the Contracting Agency so that Proposals cannot be received.

If an emergency or unanticipated event interrupts normal work processes of the Contracting Agency so that Proposals cannot be received at the office designated for receipt of bids as specified in these instructions the time specified for receipt of the Proposal will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which the normal work processes of the Contracting Agency resume.

When a Bid deposit is furnished in a physical format as specified in these instructions the Bid deposit shall be submitted in a sealed envelope marked as “BID SUPPLEMENT” and with the Bidder’s company name, project title, and Bid date.

1.13 Withdrawing, Revising, or Supplementing Proposal

After submitting a physical Bid Proposal to the Contracting Agency, the Bidder may withdraw, revise, or supplement it if:

1. The Bidder submits a written request signed by an authorized person, and
2. The Contracting Agency receives the request before the time set for receipt of Proposals.

The bidder has no right to withdraw or modify the bid for any reason whatsoever after the time set for the opening thereof, unless the award of the contract is delayed for a period exceeding sixty (60) days from the time set for opening of the bids.

Prior to the time set for opening of bids, a bidder may withdraw or revise his bid proposal, provided that an individual authorized to sign proposals files the request for withdrawal or revision with the County Purchasing Office in writing. The original proposal, as modified in writing by an attached revision filed before the time set for opening of bids will be considered as the bid proposal by the bidder. No oral, fax, telephone, or telegraphic Bid Proposals or modifications will be considered or accepted.

Unless specifically allowed in the Contract, emailed requests to withdraw, revise, or supplement a Proposal are not acceptable. The Contracting Agency is not responsible for delayed, partial, failed, illegible, or partially legible FAX document transmissions, and such documents may be rejected as incomplete at the Bidder's risk.

1.14 Irregular Proposals

1. A proposal will be considered irregular and will be rejected if:
 - a. The authorized proposal form furnished by the Contracting Agency is not used or is altered;
 - b. The completed proposal form contains any unauthorized additions, deletions, alternate bids, or conditions;
 - c. The bidder adds provisions reserving the right to reject or accept the award, or enter the contract;
 - d. A price per unit cannot be determined from the bid proposal;
 - e. The proposal form is not properly executed;
 - f. The bidder fails to submit or properly complete a subcontractor list, if applicable.
 - g. The bid proposal does not constitute a definite and unqualified offer to meet the material terms of the bid invitation, or
 - h. More than one proposal is submitted for the same project from a Bidder under the same or different names.
 - i. The bidder fails to submit or properly complete a Bidder Responsibility Checklist.
 - j. The bidder fails to submit or properly complete a Subcontractor Responsibility Checklist for each subcontractor.

2. A Proposal may be considered irregular and may be rejected if:
 - a. Any of the bid item prices are excessively unbalanced (either above or below the amount of a reasonable Bid) to the potential detriment of the Contracting Agency;
 - c. The authorized Proposal Form furnished by the Contracting Agency is not used or is altered;
 - d. The completed Proposal form contains unauthorized additions, deletions, alternate Bids, or conditions;
 - e. Receipt of Addenda is not acknowledged;
 - f. A member of a joint venture or partnership and the joint venture or partnership submit Proposals for the same project (in such an instance, both Bids may be rejected); or
 - g. If Proposal form entries are not made in ink (or typed).
 - h. If the County, for good cause, deems the bid bond inadequate or improper

1.15 Disqualification of Bidders

A Bidder may be deemed not responsible and the Proposal rejected if:

1. More than one Proposal is submitted for the same project from a Bidder under the same or different names;
2. Evidence of collusion exists with any other Bidder. Participants in collusion will be restricted from submitting further Bids;
3. A Bidder is not prequalified for the Work or to the full extent of the Bid;
4. An unsatisfactory performance record exists based on past or current Contracting Agency Work;
5. There is uncompleted work (Contracting Agency or otherwise) which might hinder or prevent the prompt completion of the Work Bid upon;
6. The Bidder failed to settle bills for labor or materials on past or current Contracts;
7. The Bidder has failed to complete a written public contract or has been convicted of a crime arising from a previous public contract;
8. The Bidder is unable, financially or otherwise, to perform the Work;
9. A Bidder is not authorized to do business in the state of Washington; or
10. There are other reasons deemed proper by the Contracting Agency
11. The Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or
12. The Bidder fails to meet the Project-specific supplemental bidder responsibility criteria listed in these instructions.

1.16 Opening of Bids

Bids received prior to the time of opening will be kept unopened and secured until the time of the bid opening as specified in the Invitation to Bid. No bid received thereafter will be considered. No responsibility will attach, and bidders waive all complaints against the County for premature opening of an improperly addressed or identified bid.

At the time and place fixed for the opening of bids, every bid received within appropriate time will be opened and publicly read aloud. The Owner reserves the right to postpone the date and time for receiving and/or opening of bids at any time prior to the date and time established in the Advertisement for Bid. Postponement notices shall be mailed to bidders in the form of addenda.

1.17 Withdrawal of Bids

The bidder has no right to withdraw or modify the bid for any reason whatsoever after the time set for the opening thereof, unless the award of the contract is delayed for sixty (60) days or more from the time set for opening of the bids.

Prior to the time set for bid opening, a bidder may withdraw or revise his bid proposal, provided that an individual authorized to sign files the request for withdrawal or revision with the County Purchasing Office in writing. The original proposal, as modified in writing by an attached revision filed before the time set for bid opening will be considered as the bid proposal by the bidder.

1.18 Modifications

No oral, fax, telephone, or telegraphic bids or modifications will be considered or accepted.

1.19 Washington State Sales Tax

Washington State Sales Tax on the Contract value is included in the bid proposal along with all other applicable taxes & fees and is included in the basic bid amount.

1.20 Federal Excise Taxes

Kitsap County is an arm and agency of the State of Washington and is exempt from payment of Federal retailer and manufacturers excise tax (Section 4055, Chapter 31, and Section 4224, Chapter 32, Internal Revenue Code of 1954) and the proposals are not to include such taxes

1.21 State Law

Applicable state laws concerning prevailing wages, hours, worker's compensation and other conditions of employment are called to the attention of the bidders for their compliance. All filing fees or permit fees required for completion of the work are to be included in the bid.

1.22 Bidder's Responsibilities

The submission of a bid shall be conclusive evidence that a bidder has made sufficient examination and has investigated and is satisfied as to the conditions to be encountered, the character, quantity, quality and scope of work, the quantities and qualities of materials to be supplied and equipment and labor to be used, and the requirements of the contract and proposal submitted, including all addenda for performance of the work.

The bidder must be familiar with all state, federal and local laws, ordinances and regulations which in any manner might affect those engaged or Employed in the work, the materials, equipment or procedures used in the work, or which in any other way might affect the conduct of the work. Bidder is assumed to be familiar with such laws and regulations, and no plea of misunderstanding or ignorance of the law will be considered.

The bidder shall determine from careful examination the methods; materials, labor and equipment required to perform the work in full and shall reflect the same in his bid price. If, during the performance of the work, methods, materials, labor or equipment required are beyond those anticipated by the bidder, he will not be entitled to additional compensation except as may be provided for elsewhere in these specifications.

1.23 Discrepancies

Should a bidder find discrepancies in, or omissions from, the drawings or specifications, or should the bidder be in doubt as to their meaning, the bidder shall at once notify the Construction Manager. If appropriate, the Construction Manager will send a written instruction to all bidders in the form of an Addendum. Neither the County nor the Construction Manager may be held responsible for any oral instruction. All addenda issued prior to the time of bid closing are incorporated into the contract.

1.24 Request for Clarifications and Discrepancies

Should a bidder have a Request for Clarification or find discrepancies, ambiguities or omissions in the drawings or specifications, or should a bidder be in doubt as to their meaning, bidder should notify Brian Stewart, Construction Manager, (360) 271-5349 or email rbstewart@kitsap.gov.

Interpretations, corrections and changes of the Bidding documents will be made by addendum only through the Kitsap County Purchasing Office. Interpretations, corrections and changes in the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

Any Variances to specifications and contract documents shall not be accepted unless agreed to by the County, and Construction Manager in writing.

Substitutions will not be considered until after award of contract.

1.25 Acceptance of Bid (Award)

It is the intent of the County to award a Contract to the lowest responsive and responsible bidder provided the Bid has been submitted in accordance with the requirements of the Project Manual. The County shall have the right to waive informalities or irregularities in bid received and to accept

the bid which, in the County's judgment, is in the County's and project's own best interest. The County may reject any bid for a failure to agree to the proposed schedule for contract performance.

The Owner will consider all material submitted by the bidder to determine whether the bidder's offering follows the Contract Documents. The Owner will consider all material submitted by the bidder, and evidence it may obtain otherwise, to determine whether the bidder, its key personnel, and proposed subcontractors have the qualifications and experience to successfully complete contracts of this type. Such evaluation will include, but not be limited to, the following factors: 1) whether the bidder has adequate financial resources to complete the work; 2) whether the bidder has the necessary experience and organization to perform the work; 3) whether the bidder has a satisfactory record of performance, integrity, experience, and skills to perform and complete the work; 4) whether the bidder has a history of completing, failing to complete, defaulting on or otherwise not completing construction contracts; and 5) whether the bidder's proposed major subcontractors appear capable of and have histories of successfully completing construction contracts.

The County retains the right to accept offered bids for 60 days following receipt of bids. If a longer duration is required, the County retains the right to request the apparent low bidder to extend the award period or adjust their price accordingly. If an adjustment is requested, the County reserves the right to request the same adjustment from other bidders.

The County may reject all bids if they exceed budgeted cost or the County may negotiate bid pricing with the apparent low responsive bidder including changes in the contract plans and specifications, to bring the bid within budgeted cost (RCW 39.10.080).

1.26 Pre-Award Information

Before awarding any contract, the Contracting Agency may require one or more of these items or actions of the apparent lowest responsible bidder:

1. A complete statement of the origin, composition, and manufacture of any or all materials to be used,
2. Samples of these materials for quality and fitness tests,
3. A progress schedule (in a form the Contracting Agency requires) showing the order of and time required for the various phases of the work,
4. A breakdown of costs assigned to any bid item,
5. Attendance at a conference with the Construction Manager or representatives of the Construction Manager,
6. Obtain, and furnish a copy of, a business license to do business in the city or county where the work is located.
7. Any other information or action taken that is deemed necessary to ensure that the bidder is the lowest responsible bidder.

1.27 Time of Completion:

The work of this project shall be completed within the time established in Section 00 70 00 from the date of Notice to Proceed.

1.28 Notice to Proceed

The County will issue a Notice to proceed upon receipt in proper form and approval of the required contract, bonds, certificates and other required submittals. No proposal is binding upon the County until the Board of County Commissioners duly executes the contract. No work shall be performed within the project limits prior to the receipt of the Notice to Proceed, and any work performed outside such area or materials ordered prior to the receipt of the Notice to Proceed shall be at the sole risk of the Contractor.

1.29 Summary of Bid Documentation

IT IS MANDATORY THAT EACH BIDDER COMPLETE AND SUBMIT WITH ITS BID DOCUMENTATION REQUIRED BY THE CONTRACT DOCUMENTS, INCLUDING, BUT NOT LIMITED TO THE FOLLOWING:

- A. Bid Proposal with acknowledgement of addenda
- B. Bid Guaranty Bond
- C. Subcontractor's List
- D. Bidder Information
- E. Bidder Responsibility Checklist
- F. Non-Collusion Affidavit Certificate
- G. Certification of Compliance with Wage Payment Statutes
- H. Schedule of Values

***Pursuant to Title 39 of the RCW the bidder is required to submit (a) Within forty-eight hours after the published bid submittal time, the names of the subcontractors with whom the bidder, if awarded the contract, 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;**

A list of subcontractors shall be provided to the Kitsap County Purchasing Department.

****END OF SECTION****

COUNTY CAPITAL PROJECTS

CONTRACT AGREEMENT

COUNTY CAPITAL PROJECTS CONTRACT AGREEMENT

CAPITAL PROJECTS CONTRACT AGREEMENT

KC Contract # _____

This Contract is made and entered into this _____ day of _____, 2022 between KITSAP COUNTY, with its principal offices at 614 Division Street, Port Orchard, Washington 98366, hereinafter called the Contracting Agency, and _____, a general Contractor licensed in the State of Washington, with its principal offices located at _____, hereinafter the Contractor.

WITNESSETH:

WHEREAS, the Contracting Agency desires to construct the Central Kitsap Treatment Plant HVAC Upgrades and

WHEREAS, the Contractor has been selected by competitive bid as the responsible bidder with the lowest responsive bid as is required by Chapter 39.04 RCW.

NOW THEREFORE, the Contracting Agency and Contractor mutually agree as follows:

1. CONTRACT DOCUMENTS

The Agreement between the parties is expressed in the Contract Documents, which include the Invitation to Bid; the accepted Bid Proposal; the Bid Guaranty Bond; the Subcontractor’s List; the Bidder Information; the Non-Collusion Affidavit; the Performance and Payment Bond; the Special Provisions; the Project Drawings; the Standard Specifications and Standard Plans; the Storm Water Pollution Prevention Plan; the Project Permits; and this Agreement.

2. DESCRIPTION OF THE WORK

This contract provides for the construction of Central Kitsap Treatment Plant HVAC Upgrades in accordance with the Contract Documents entitled “Central Kitsap Treatment Plant HVAC Upgrades”. Contractor agrees to furnish all material, labor, carriage, tools, equipment, apparatus, facilities and anything else necessary to complete the work in a professional and workmanlike manner.

The Contractor shall complete its Work in a timely manner and in general accordance with the agreed schedule submitted by the Contractor and approved by the Contracting Agency.

3. CONTRACT REPRESENTATIVES

Each party to this Contract shall have a representative. Each party may change its representative upon providing written notice to the other party. These representatives will be:

CONTRACTING AGENCY:

Name of Representative: Brian Stewart
Title: Construction Manager
Mailing Address: 12351 Brownsville Hwy
City, State, and Zip Code: Poulsbo, WA 98370
Telephone Number: 360-271-5349
Email Address: rbstewart@kitsap.gov

COUNTY CAPITAL PROJECTS CONTRACT AGREEMENT

CONTRACTOR:

Name of Representative: _____
Title: _____
Mailing Address: _____
City, State, and Zip Code: _____
Telephone Number: _____
Fax Number: _____
Email Address: _____

All instructions, modifications, and changes to the Contract shall be conveyed to the Contractor through the Contracting Agency's Representative. Any work executed upon the direction of any person or entity other than the Contracting Agency's Representative may be considered defective and will be performed without reimbursement for said work to the Contractor. The Contracting Agency's Representative shall have the authority to reject any and all nonconforming or defective work under the Project Documents.

4. CONTRACT AMOUNT

The Contracting Agency hereby agrees to pay the Contractor according to the Contractor's Bid in the amount of \$_____ (including accepted alternates and Washington State Sales Tax (WSST)), at the time and manner and upon the conditions provided for in this Contract.

5. CONTRACT TIME

Time is of the essence in the performance of this Contract. The Contractor agrees to work promptly and fully complete the work within the limits as described in the Contract Documents. Failure to complete the work within the allowed time limit as described in Section 00 70 00 of the contract specification will subject the Contractor to the payment of liquidated damages as described Section 00 70 00.

6. PREVAILING WAGES

Contractor shall be responsible for complying with the prevailing wage requirements associated with RCW Chapter 39.12 and WAC 296-127 as further described in Section 00 70 00 of the contract specifications.

7. PERFORMANCE AND PAYMENT BOND

Contractor agrees to provide a Performance and payment Bond as described in Section 00 70 00 of the contract specifications.

8. HOLD HARMLESS AND INDEMNIFICATION

The Contractor shall hold harmless, indemnify and defend the Contracting Agency, Construction Manager, its officers, officials, employees and agents, from and against any and all claims, actions, suits, liability, loss, expenses, damages, and judgments of any nature whatsoever, including, but not limited to, reasonable costs and attorneys' fees in defense thereof, for injury, sickness, disability or death to persons or damage to property or business, caused by or arising out of the performance of the services rendered under this contract by the Contractor, its employees, agents, or subcontractors or anyone for whose acts any of them may be liable. Provided however, that the Contractor's obligation hereunder shall not extend to injury, sickness, death or damage caused by or arising out of the sole negligence of the Contracting Agency, its officers, officials, employees or agents. Provided further, that in the event

COUNTY CAPITAL PROJECTS CONTRACT AGREEMENT

of the concurrent negligence of the parties, the Contractor's obligations hereunder shall apply only to the percentage of fault attributable to the Contractor, its employees, agents, or subcontractors.

In any and all claims against the Contracting Agency, Construction Manager, its officers, officials, employees and agents by any employee of the Contractor, subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation under this Section shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or subcontractor under Worker's Compensation acts, disability benefit acts, or other employee benefit acts, it being clearly agreed and understood by the parties hereto that the Contractor expressly waives any immunity the Contractor might have had under such laws. By executing the Contract, the Contractor acknowledges that the foregoing waiver has been mutually negotiated by the parties and that the provisions of this Section shall be incorporated, as relevant, into any contract the Contractor makes with any subcontractor or agent performing Work hereunder.

The Contractor's obligations hereunder shall include, but are not limited to, investigating, adjusting and defending all claims alleging loss from action, error or omission, or breach of any common law, statutory or other delegated duty by the Contractor, the Contractor's employees, agents or subcontractors.

9. INSURANCE

Contractor agrees to comply with the insurance requirements described in Section 00 70 00 of the contract specifications.

10. TERMINATION

This contract may be terminated by the officials or agents of the County authorized to contract for or supervise the execution of such work in accordance with Section 00 70 00 of the contract specifications.

11. NON-WAIVER OF RIGHTS

The parties agree that the excuse or forgiveness of performance or waiver of any provisions of this Contract does not constitute a waiver of such provisions for future performance, or prejudice the right of the waiving party to enforce any of the provisions of this Contract at a later time.

12. INDEPENDENT CONTRACTOR

The Contractor shall perform this Contract as an Independent Contractor and not as an agent, employee or servant of the Contracting Agency. The parties agree that the Contractor is not entitled to any benefits or rights enjoyed by employees of the County. Contractor shall comply with all laws regarding workers' compensation.

The Contractor specifically has the right to direct and control Contractor's own activities in providing the agreed services in accordance with the specifications set out in this Contract. Furthermore, the Contractor shall have and maintain complete responsibility and control over all of its subcontractors, employees, agents, and representatives. No subcontractor, employee, agent, or representative of the Contractor shall be or deem to be or act or purport to act as an employee, agent, or representative of the Contracting Agency, unless otherwise directed by the terms of this Contract.

The Contractor agrees to immediately remove any of its employees or agents from assignment to perform services under this Contract upon receipt of a written request to do so from the Contracting Agency's Representative or designee.

13. NONDISCRIMINATION

The Contractor, its assignees, delegates, or subcontractors in the performance of this Contract shall not discriminate against any person on the basis of race, color, creed, religion, national origin, age, sex, marital status, sexual

COUNTY CAPITAL PROJECTS CONTRACT AGREEMENT

orientation, veteran status, disability, or other circumstance prohibited by federal, state, or local law, and shall comply with Title VI of the Civil Rights Act of 1964, P.L. 88 354 and Americans with Disabilities Act of 1990.

14. CHOICE OF LAW, JURISDICTION AND VENUE

Any action at law, suit in equity, or other judicial proceeding for the enforcement of this contract or any provisions thereof shall be instituted as provided for in RCW 36.01.050. It is mutually understood and agreed that this contract shall be governed by the laws of the State of Washington, both as to interpretation and performance.

15. SUCCESSORS AND ASSIGNS

The Contracting Agency, to the extent permitted by law, and the Contractor each bind themselves, their partners, successors, executors, administrators, and assigns to the other Party to this Contract and to the partners, successors, administrators, and assigns of such other party in respect to all covenants of this Contract.

16. ASSIGNMENT, DELEGATION, AND SUBCONTRACTING

- a. The CONTRACTOR shall perform the terms of the contract using only its bona fide employees or agents, and the obligations and duties of the CONTRACTOR under this Contract shall not be assigned, delegated, or subcontracted to any other person or firm without the prior express written consent of the COUNTY.
- b. The CONTRACTOR warrants that it has not paid nor has it agreed to pay any company, person, partnership, or firm, other than a bona fide employee working exclusively for CONTRACTOR, any fee, commission, percentage, brokerage fee, gift, or other consideration contingent upon or resulting from the award or making of this Contract.

17. SEVERABILITY

If a court of competent jurisdiction holds any part, term or provision of this Contract to be illegal, or invalid in whole or in part, the validity of the remaining provisions shall not be affected, and the parties' rights and obligations shall be construed and enforced as if the Contract did not contain the particular provision held to be invalid.

If it should appear that any provision of this Contract is in conflict with any statutory provision of the United States or the State of Washington, said provision which may conflict therewith shall be deemed inoperative and null and void insofar as it may be in conflict therewith, and shall be deemed modified to conform to such statutory provision.

18. ENTIRE AGREEMENT

The parties agree that this Contract is the complete expression of its terms and conditions. Any oral or written representations or understandings not incorporated in this Contract are specifically excluded.

19. NOTICES

Any notices shall be effective if personally served upon the other party or if mailed by registered or certified mail, return receipt requested, to the addresses set out in Section 3. Notice may also be given by facsimile with the original to follow by regular mail. Notice shall be deemed to be given three days following the date of mailing or immediately if personally served. For service by facsimile, service shall be effective upon receipt during working hours. If a facsimile is sent after working hours, it shall be effective at the beginning of the next working day.

20. THIRD PARTY BENEFICIARY

All parties agree that the State of Washington shall be, and is hereby, named as an express third-party beneficiary of this contract, with full rights as such.

COUNTY CAPITAL PROJECTS CONTRACT AGREEMENT

21. MODIFICATION

All amendments or modifications shall be in writing, signed by both parties, and attached to this Contract.

22. COMPLIANCE WITH LAWS

The CONTRACTOR shall comply with all applicable federal, state and local laws, rules and regulations in performing this Contract.

23. COMPLIANCE WITH PUBLIC RECORDS ACT

Contractor acknowledges that the County is subject to the Public Records Act, chapter 42.56 RCW ("PRA"). All records owned, used, or retained by the County are public records subject to disclosure unless exempt under the Act, whether or not such records are in the possession or control of the County or Contractor. Contractor shall cooperate with the County so County may comply with all of its obligations under the Act. Contractor shall promptly provide County with all records relating to this Agreement requested by County for purposes of complying with the PRA. In addition to its other indemnification and defense obligations under this Agreement, Contractor shall indemnify and defend the County from and against any and all losses, penalties, fines, claims, demands, expenses (including, but not limited to, attorney's fees and litigation expenses), suits, judgments, or damage arising from or relating to any failure of Contractor to comply with this subsection. This subsection shall survive expiration or termination of the Agreement.

This Contract shall take effect this _____ day of _____, 2022.

CONTRACTOR

BOARD OF COUNTY COMMISSIONERS
Kitsap County, Washington

Firm _____

Christine Rolfes, Chair

Signature: _____
(Authorized Representative)

Katie Walters, Commissioner

Title: _____

Address: _____

Oran Root, Commissioner

Attest:

Contractor Registration No. _____

Dana Daniels, Clerk of the Board

Federal Tax ID No. _____

Approved as to form by the Prosecuting Attorney's Office.

END OF CAPITAL PROJECTS CONTRACT AGREEMENT

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PUBLIC WORKS PAYMENT BOND

Title

Title

Name, address, and telephone of local office/agent of Surety Company are:

Approved as to form:

Signature

Title

Date

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PERFORMANCE BOND TO KITSAP COUNTY, WA

Bond No. _____

The Kitsap County, Washington, (County) has awarded to _____ (Principal), a contract for the construction of the project designated as **Central Kitsap Treatment Plant HVAC Upgrades**, Kitsap County Contact #KC-____ - ____, in Kitsap County, Washington (Contract), and said Principal is required to furnish a bond for performance of all obligations under the Contract.

The Principal, and _____ (Surety), a corporation organized under the laws of the State of _____ and licensed to do business in the State of Washington as surety and named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Dept., are jointly and severally held and firmly bound to the County, in the sum of _____

_____ US Dollars

(\$ _____) Total Contract Amount, subject to the provisions herein.

This statutory performance bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall well and faithfully perform all of the Principal's obligations under the Contract and fulfill all the terms and conditions of all duly authorized modifications, additions, and changes to said Contract that may hereafter be made, at the time and in the manner therein specified; and if such performance obligations have not been fulfilled, this bond shall remain in full force and effect.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, and waives notice of any change, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

This bond may be executed in two (2) original counterparts, and shall be signed by the parties' duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and original power of attorney for the officer executing on behalf of the surety.

PART 01 DEFINITIONS OF WORDS AND TERMS

Acceptance. Formal action of the Contracting Agency in determining the Contractor's work has been completed in accordance with the contract.

Act of God. A cataclysmic phenomenon of nature, such as an earthquake, flood or cyclone. Rain, wind, high water, or other natural phenomenon which might reasonably have been anticipated from historical records of the general locality of the work shall not be construed as acts of God.

Addenda. Supplemental written specifications or drawings issued prior to execution of the contract which modify or interpret the project manual by addition, deletion, clarification, or corrections.

Bid. Offer of a bidder submitted on the prescribed form setting forth the price or prices of the work to be performed.

Bidder. Individual, partnership, corporation, or a combination thereof, including joint ventures, offering a bid to perform the work.

Construction Manager. The person designated in writing by the Contracting Agency to act as its representative and to perform administrative functions relating to this contract. Initial contact by the Contractor with the Contracting Agency shall be through the Construction Manager.

Contract. The written agreement between the Contracting Agency and the Contractor. It describes, among other things: 1. What work will be done, and by when; 2. Who provides labor and materials; and 3. How Contractors will be paid. The Contract includes the Contract Agreement, Bidder's completed Proposal Form, Contract Provisions, Plans, Specifications, Addenda, various certifications and affidavits, supplemental agreements, and change orders

Contract Price. The amount payable to the Contractor under the terms and conditions of the contract provisions based on the lump sum price with adjustments made in accordance with the Contract.

Contract Time. The time established by the terms and conditions of the contract within which the work must be physically completed.

Contracting Agency. Kitsap County Department of Public Works. Under this contract, "Contracting Agency" and "the County" are used interchangeably.

Contractor. The individual, partnership, corporation, or combination thereof, including joint venturers who enter the contract with the Contracting Agency for the performance of the work. The term covers subcontractors, equipment and material suppliers, and their employees.

Dates:

Bid Opening – The date on which the Contracting Agency publicly opens and reads bids.

Award Date – The date of the formal decision of the Contracting Agency to accept the lowest, responsible, and responsive bidder for the work.

Contract Execution – The date the Contracting Agency officially binds the agency to the Contract.

Limited Notice to Proceed – The date stated in the Limited Notice to Proceed at which the Preconstruction Phase contract time begins.

Notice to Proceed with Construction – The date stated in the Notice to Proceed with Construction on which the Construction Phase contract time begins.

Substantial Completion – The day the Construction Manager determines the Contracting Agency has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoint, any remaining traffic disruptions will be rare and brief, and only minor incidental work, or correction or repair remains for the physical completion of the total contract.

Physical Completion – The date all the work is physically completed on the project. All documentation required by the Contract and required by law does not necessarily need to be furnished by the Contractor by this date.

Completion – The day all work specified in the contract is complete and all contract obligations are fulfilled by the Contractor. All documentation required by the contract and required by law must be furnished by the Contractor before establishment of this date.

Final Acceptance – The date on which the Contracting Agency accepts the work as complete.

Field Directive – A written order issued by Construction Manager or Inspector which requires minor changes in the Work, but which does not involve a change in the contract price or term.

Inspector – The Contracting Agency’s representative who inspects Contract performance in detail.

Performance and Payment Bond – The definition is the same as that provided for the term “Contract Bond.” The Contractor will be required to submit a Performance and Payment Bond on the form provided by the Contracting Agency within ten (10) calendar days of receipt of Notice of Award.

Person. The term, person, includes firms, companies, corporations, partnerships, and joint ventures, as well as persons.

Proposal Form – The form provided to Bidders by the Contracting Agency for submittal of a Proposal or Bid to the Contracting Agency for a specific project. The form includes the item number, item description of the Bid items along with blank spaces to be completed by the Bidder for the prices, the total Bid amount, signatures, date, acknowledgment of Addenda, and the Bidder’s address. The required certifications and declarations are part of the form.

RCW. Abbreviation for the Revised Code of Washington.

Work. The labor, materials, equipment, supplies, services, and other items necessary for the execution, completion and fulfillment of the contract.

Working Day. A working day shall have the same meaning as a business day and is any day from Monday through Friday except holidays as listed in these provisions.

PART 02 SCOPE OF THE WORK

The Contractor shall provide all labor, materials, tools, equipment, transportation, supplies, and incidentals required to complete all Work for the items included in the Contract Documents. Contractor also must ensure one lab be maintained and fully functional during construction. This will include safe access to the lab as well as maintaining a constant temperature of 68 degrees or current conditions.

The specifications and drawings are intended to be explanatory of each other. Work specified on the drawings and not the specifications, or vice versa, shall be executed as if specified in both.

When the Contract specifies Work that has no Bid item, and the Work is not specified as being included with or incidental to other Bid items, an equitable adjustment (see PART 09 of this section) will be made unless that Work is customarily considered as incidental to other items.

The complete Contract includes these parts: the Contract Form, Bidder's completed Proposal Form, Contract Plans, Contract Provisions, Specifications, Standard Plans, Addenda, various certifications and affidavits, supplemental agreements, and change orders. These parts complement each other in describing a complete Work. Any requirement in one part binds as if stated in all parts.

The Contractor shall provide all Work or materials clearly implied in the Contract even if the Contract does not mention it specifically.

Any inconsistency in the parts of the Contract shall be resolved by following this order of precedence (e.g., 1 presiding over 2, 3, 4, 5, and 6; 2 presiding over 3, 4, 5, and 6; and so forth):

1. Addenda,
2. Proposal Form,
3. Standard Specifications
4. Contract Plans,

In cases of conflict between the specifications and drawings, the specifications shall govern. Figure dimensions on drawings shall govern over scale dimensions and detail drawings shall govern over general drawings. In the event an item of work is described differently in two or more locations in the drawings and in the specifications, the Contractor shall, upon request of the Construction Manager, submit in writing to the Construction Manager the description upon which the Contractor relied in preparing his bid or laying out the work. If the Construction Manager directs the Contractor to perform work in a manner other than that contemplated by the Contractor in preparing his bid or laying out the work, the Construction Manager will initiate a change order.

In this event, the Contractor shall submit to the Construction Manager such supporting information, including bidding or layout documents, as may reasonably be necessary for the Construction Manager to determine whether the contract price is increased, decreased or unchanged by the change order.

This order of precedence shall not apply when Work is required by one part of the Contract but omitted from another part or parts of the Contract. The Work required in one part must be furnished even if not mentioned in other parts of the Contract. Whenever reference is made in these Specifications to codes, rules, specifications, and standards, the reference shall be construed to mean the code, rule, specification, or standard that is in effect on the Bid advertisement date, unless

otherwise stated or as required by law.

If any part of the Contract requires Work that does not include a description for how the Work is to be performed, the Work shall be performed in accordance with standard trade practice(s). For purposes of the Contract, a standard trade practice is one having such regularity of observance in the trade as to justify an expectation that it will be observed by the Contractor in doing the Work.

In case of ambiguities or disputes over interpreting the Contract, the Construction Manager's decision will be final.

In the event the work to be done or matters relative thereto are not sufficiently detailed or explained in the contract documents, the Contractor shall apply to the Construction Manager for further explanations as may be necessary and shall conform thereto so far as may be consistent with the terms of the contract. In the event of doubt or question arising respecting the true meaning of the specifications or drawings, reference shall be made to the Construction Manager for his decision.

Should the Contractor disagree with the Construction Manager's decision, he may appeal to the Director in accordance with PART 03 of this section.

Changes

The Construction Manager reserves the right to make, at any time during the Work, such changes in quantities and such alterations in the Work as are necessary to satisfactorily complete the project. Such changes in quantities and alterations shall not invalidate the Contract nor release the Surety, and the Contractor agrees to perform the Work as altered. Among others, these changes and alterations may include:

1. Deleting any part of the Work.
2. Increasing or decreasing quantities.
3. Altering Specifications, designs, or both.
4. Altering the way the Work is to be done.
5. Adding new Work.
6. Altering facilities, equipment, materials, or services provided by the Contracting Agency.
7. Ordering the Contractor to speed up or delay the Work.

If the alterations or changes in quantities significantly change the character of the Work under the Contract, whether changed by any such different quantities or alterations, an adjustment, excluding loss of anticipated profits, will be made to the Contract. The basis for the adjustment shall be agreed upon prior to the performance of the Work. If a basis cannot be agreed upon, then an adjustment will be made either for or against the Contractor in such amount as the Construction Manager may determine to be fair and equitable. If the alterations or changes in quantities do not significantly change the character of the Work to be performed under the Contract, the altered Work will be paid for as provided elsewhere in the Contract.

If the Construction Manager determines that the change increased or decreased the Contractor's costs or time to do any of the Work including unchanged Work, the Construction Manager will make an equitable adjustment to the Contract. The equitable adjustment will be by agreement with the Contractor. However, if the parties are unable to agree, the Construction Manager will determine the amount of the equitable adjustment and adjust the time as the Construction Manager deems appropriate. Extensions of

time will be evaluated in accordance with contract provisions. The Construction Manager's decision concerning equitable adjustment and extension of time shall be final.

The Contractor shall proceed with the Work upon receiving:

1. An executed order, or
2. An oral or written order from the Construction Manager before receiving the executed change order.

Within 14 calendar days of delivery of the change order the contractor shall endorse and return the change order, request an extension of time for endorsement or respond in accordance with protest provisions in PART 03 of this Section. The Contracting Agency may unilaterally process the change order if the Contractor fails to comply with these requirements or when the Contractor protests.

The Contractor accepts all requirements of a change order by: (1) endorsing it, (2) not responding within the allotted time, or (3) not protesting. A change order that is not protested shall be full payment and final settlement of all claims for Contract time and for all costs of any kind, including costs of delays, related to Work either covered or affected by the change.

The Contractor shall obtain written consent of the Surety or Sureties if the Construction Manager requests such consent.

Minor Changes

At the discretion of the Contracting Agency, payments or credits for changes may be made as a "Minor Change". This procedure for Minor Changes may be used in lieu of the more formal procedure as outlined above.

The Contractor will be provided a copy of the completed order for Minor Changes. The agreement for the Minor Change will be documented by signature of the Contractor, or notation of verbal agreement. If the Contractor disagrees with anything required by the order for Minor Change, the Contractor may protest the order.

To provide a common Proposal for all Bidders, the Contracting Agency has included an allowance amount for “Minor Changes” in the Proposal to become a part of the total Bid by the Contractor.

Differing Site Conditions

If the Contractor believes that (1) any technical data on which the Contractor relied is inaccurate, or (2) any physical condition uncovered or revealed at the site differs materially from that indicated in the Contract Documents, then the Contractor shall promptly notify the Construction Manager in writing about the inaccuracy or difference.

If the Construction Manager concurs that an inaccuracy or material difference exists and that such inaccuracy or material difference will cause an increase or decrease in the Contractor's cost of or time required for performance of the work, a change order incorporating the necessary revisions shall be prepared in accordance with these provisions and submitted to the Construction Manager. If the Construction Manager finds there is no such inaccuracy or material difference, or if no decision is made in writing within 10 days of the written notice by the Contractor, the Contractor must submit a claim to the Construction Manager.

PART 03 CONTROL OF WORK**County Sewer Utility Division Director**

Should the Contractor disagree with the Construction Manager's decision with respect to the Contract, the Contractor may request that the Sewer Utility Division Director or the Director's designee review the Construction Manager's decision and decide on behalf of Kitsap County.

County Construction Manager

The County Construction Manager shall be satisfied that all the Work is being done in accordance with the requirements of the Contract. The Contract and Specifications give the Construction Manager authority over the Work. Whenever it is so provided in this Contract, the decision of the Construction Manager shall be final: provided, however, that if a written protest is brought within the time allowed in the Contract, challenging the Construction Manager's Written Determination or decision, the protest addressing that Written Determination or decision shall be addressed by the Sewer Utility Division Director.

The Construction Manager's decisions will be final on all questions including the following:

1. Quality and acceptability of materials and Work,
2. Acceptability of rates of progress on the Work,
3. Interpretation of Plans and Specifications,
4. Determination as to the existence of changed or differing site conditions,
5. Fulfillment of the Contract by the Contractor,
6. Payments under the Contract including equitable adjustment,
7. Suspension(s) of Work,
8. Termination of the Contract for default or public convenience,
9. Determination as to unworkable days, and
10. Approval of Working Drawings.

The Construction Manager represents the Contracting Agency with full authority to enforce Contract requirements. If the Contractor fails to respond promptly to the requirements of the Contract or orders from the Construction Manager:

1. The Construction Manager may use Contracting Agency resources, other contractors, or other means to accomplish the Work; and

2. The Contracting Agency will not be obligated to pay the Contractor and will deduct from the Contractor's payments all costs that result from any other means used to carry out the Contract requirements or Construction Manager's orders.

At the Contractor's risk, the Construction Manager may suspend all or part of the Work in accordance with the provisions of this section.

Nothing in these Specifications or in the Contract requires the Construction Manager to provide the Contractor with direction or advice on how to do the Work. If the Construction Manager approves or recommends methods or manners for doing the Work or producing materials, the approval or recommendation shall not:

1. Guarantee that following the method or manner will result in compliance with the Contract,
2. Relieve the Contractor of any risks or obligations under the Contract, or
3. Create a Contracting Agency liability.

County Inspector

The County Inspector has the authority to determine if the Work and materials meet the Contract requirements, reject defective material and suspend Work that is being done improperly, subject to the final decisions of the Construction Manager.

The County Inspector is not authorized to accept Work, to accept materials, to issue instructions, or to give advice that is contrary to the Contract. Work done or material furnished that does not meet the

Contract requirements shall be at the Contractor's risk and shall not be a basis for a claim even if the Inspectors or assistants purport to change the Contract.

The County Inspector may advise the Contractor of faulty Work or materials or infringements of the terms of the Contract; however, failure of the Construction Manager or the assistants or Inspectors to advise the Contractor does not constitute acceptance or approval.

The Contracting Agency or the Contracting Agency's Representatives shall have the right to inspect and obtain copies of all written licenses, permits, or approvals issued by any governmental entity or agency to the Contractor, its delegates, or subcontractors, which are applicable to the performance of this Contract, and to inspect all Work and Materials for conformity with the Contract terms. The Contractor shall be responsible for ensuring the Work and materials conform to the Contract terms even if the Contracting Agency or the Contracting Agency's Representative conducts any inspection of the same.

Suggestions To Contractor

Any plan or method of work suggested by any representative of Kitsap County to the Contractor but not specified or required by the Contract Documents, if adopted or followed by the Contractor in whole or in part, shall be used at the risk and responsibility of the Contractor. The Construction Manager assumes no responsibility therefore and in no way will be held liable for any defects in the work which may result from or be caused by use of such plan or method of work. The Contractor shall provide the Construction Manager and Inspector with information requested in connection with the inspection of the work and administration of this Contract.

Contractor's Superintendent

The Contractor shall in writing notify the Construction Manager of the name of the Contractor's Superintendent. The Contractor's Superintendent shall provide on-site supervision of all work performed by the Contractor to its Subcontractors to ensure that the provisions of the Contract are met and all necessary supplies, services, materials, equipment, tools and labor are provided without delay. The Contractor's Superintendent shall have the authority to act for the Contractor in all matters relating to this Contract unless the Construction Manager is advised in writing of limitations on said authority. The Contractor shall provide full-time supervision whenever its employees, subcontractors or suppliers are performing work under this Contract.

Construction Procedures

The Contractor shall actively always supervise and direct the work. The Contractor shall determine the means, methods, techniques, sequences and procedures of construction, except in those instances where the Contract Documents, define the quality or sequencing of an item of work, specify a means, method, technique, sequence or procedure for construction of that item of work.

Subcontractors, Manufacturers and Suppliers

The Contractor shall be responsible for the adequacy, timeliness, efficiency and sufficiency of its subcontractors, manufacturers, suppliers and their employees. References in the Contract, if any, to actions required of subcontractors, manufacturers, suppliers, or any person other than the Contractor, Kitsap County or the Construction Manager shall be interpreted as requiring that the Contractor shall require such subcontractor, manufacturer, supplier or person to perform the specified action.

Contractor's Employees

The Contractor shall be responsible for the adequacy, timeliness, efficiency and sufficiency of its employees. Workers shall have sufficient knowledge, skill and experience to perform properly the work assigned to them. The Contractor's and its subcontractor's employees shall be properly licensed, registered or certified, as applicable, to perform their assigned work. Upon request of the Construction Manager, the Contractor shall provide copies of licenses, registrations or certifications held by its employees. In addition, any such employee determined by the Construction Manager in writing not to be sufficiently qualified to perform assigned work or not to be appropriately cooperative with the Construction Manager shall be removed by the Contractor from all work under this Contract.

Payment For Labor and Materials

The Contractor shall pay and require its subcontractors to pay all accounts for labor including workers compensation premiums, state unemployment and federal social security payments and other wage and salary deductions required by law. The Contractor also shall pay and cause its subcontractors to pay all accounts for services, equipment, and materials used by it and its subcontractors during the performance of work under this Contract. Such accounts shall be paid by the Contractor as they become due and payable. If requested by the Construction Manager, the Contractor shall promptly furnish proof of payment of such accounts.

Attention To Work

The Contractor, acting through its Representative, shall give personal attention to and shall manage the work so that it shall be prosecuted faithfully and completed in accordance with all requirements of the Contract. When the Contractor's Representative is not personally present at the site, its designated alternate shall be available and shall have the authority to act in matters relating to this Contract.

The Contractor shall not make an alteration or variation in, addition to, or deviation or omission from the requirements of this Contract without the written consent of the Construction Manager. Unless such written consent expressly so provides, any such alteration, variation, addition, deviation or omission by the Contractor shall not result in any extra compensation or extension of time.

Protection of Existing Facilities

The Contractor shall take every precaution to protect all public and private property during the performance of the contract. Any damages caused by contractor's personnel or equipment will be promptly replaced or repaired to the condition existing before the damage. All such costs for such repairs or replacement shall be the sole responsibility of the contractor.

Submittals

Where required by the specifications, the Contractor shall submit specified information which will enable the Construction Manager to advise the Contracting Agency whether the Contractor's proposed materials, equipment or methods of work are in general conformance to the design concept and in compliance with the drawings and specifications. The requirements for submittals are specified in Section 01 30 00.

Control Of Material, Equipment and Workmanship

Unless otherwise specifically stated in the contract documents, the Contractor shall provide and pay for materials, labor, tools, equipment, lighting, transportation, supervision, and temporary construction of any nature, and other services and facilities of any nature, whatsoever necessary, to execute, complete and deliver the work within the specified time. Material and equipment shall be new and of a quality equal to that specified. Equipment offered shall be current modifications which have been in successful regular operation under comparable conditions. This requirement does not apply to minor details, nor to

thoroughly demonstrated improvements in design or in materials of construction. Construction work shall be executed in conformity with the standard practice of the trade.

Where required by the specifications, the Contractor shall provide product data which is a submittal furnished for information only. The information and data furnished is required by the Contracting Agency for inspecting, testing, operating and maintaining parts of the work. The requirements for product data are specified in Section 01 60 00.

Where the contract requires that materials or equipment be provided or that construction work be performed, and detailed specifications of such materials, equipment or construction work are not set forth, the Contractor shall perform the work using materials and equipment of the best grade in quality and workmanship obtainable in the market, from firms of established good reputations, and shall follow standard practices in the performance of construction work. The work performed shall be in conformity and harmony with the intent to secure the standard of construction and equipment of work as a whole and in part.

Material And Equipment Specified by Name

When material or equipment is specified by reference to two or more patents, brand names, or catalog numbers, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements, and that other materials or equipment, of equal capacities, quality and function shall be considered by the Contracting Agency upon the Contractor's request for substitution.

If material or equipment is specified by only one patent or proprietary name, or by the name of only one manufacturer, it is for the purpose of standardization, or because the Contracting Agency knows of no equal. If standardization is the reason for using one name to specify any material or equipment, the specifications will so state, and substitutions will not be considered. In other cases, the Contractor may offer substitutions of products considered to be equal to that specified.

Requests For Substitution

The Contractor may offer material or equipment of equal or better quality and performance in substitution for those specified only after award of the contract. The Contracting Agency will consider offers for substitution only from the Contractor and will not acknowledge or consider such offers from suppliers, distributors, manufacturers, or subcontractors. The Contractor's offers of substitution shall be made in writing to the Construction Manager and shall include sufficient data to enable the Construction

Manager to assess the acceptability and benefit to the Contracting Agency of the material or equipment for the application and requirements.

If the substitution offered necessitates changes to or coordination with other portions of the work, the data submitted shall include drawings and details showing such changes. Contractor agrees to perform these changes as part of the substitution of material or equipment at no additional cost to the Contracting Agency. Within 30 calendar days after receipt of the offer of substitution, the Construction Manager will review the material submitted by the Contractor and advise the Contractor of objections, if any, to the proposed substitution or if further information is required.

Upon notification by the Construction Manager, the Contractor shall either provide material or equipment which complies with project specifications or furnish requested additional information.

While the Construction Manager might not take any objections to the proposed substitution, such action shall not relieve the Contractor from responsibility for the efficiency, sufficiency, quality and performance of the substitute material or equipment, in the same manner and degree as the material and equipment specified by name. Any proposed cost differential associated with a substitution shall be reflected in the offer and, if the substitution is accepted, the contract documents shall be modified by a change order.

Defective Work

When, and as often as the Construction Manager determines through his inspection procedures, material, equipment or workmanship incorporated in the project do not meet the requirements of the contract, the Construction Manager shall give written notice of the noncompliance to the Contractor.

Within five days from the receipt of such notice, the Contractor shall undertake the work necessary to correct the deficiencies, and to comply with the contract. If the Contractor disagrees with the Construction Manager's determination and believes that the corrective work should be covered by a change order, he shall immediately notify the Contracting Agency's Representative, in writing, setting forth his position. Within five days after receipt of the Contractor's notification, the Contracting Agency's Representative will review the matter and notify the Contractor, in writing, of his determination.

If the Contracting Agency's Representative determines that the corrective work is required to comply with the contract, the Contractor shall proceed with such work. As a condition precedent to the Contractor's request for either additional compensation or time extension, or both, resulting from the performance of such corrective work, the Contractor shall, within 15 calendar days after receipt of the Contracting Agency's Representative's determination, notify the Contracting Agency's Representative in writing of his intent to claim additional compensation, time or both. The Contractor shall document the cost information associated with the corrective work with daily records and shall provide such information to the Construction Manager monthly. Receipt of the cost data by the Construction Manager shall not be construed to be acceptance of the corrective work, or an authorization for a change order to cover the corrective work.

Prior to acceptance of the project, the Contracting Agency may, at his option, retain work which is not in compliance with the contract if the Contracting Agency determines that such defective work is not of sufficient magnitude or importance to make the work dangerous or undesirable. The Contracting Agency also may retain defective work, if, in the opinion of the Construction Manager, removal of such work is impractical or will create conditions which are dangerous or undesirable. Just and reasonable value for such defective work shall be judged by the Contracting Agency and appropriate deductions shall be made in the payments due, or to become due to the Contractor. Final acceptance shall not act as a waiver of the Contracting Agency's right to recover from the Contractor an amount representing the deduction for retention of defective work.

Materials And Equipment Furnished by Contracting Agency

Materials and equipment specified to be furnished by the Contracting Agency shall be installed by the Contractor. Furnishing of material and equipment by the Contracting Agency will be considered conclusive evidence of their acceptability for the purpose intended. If the Contractor discovers defects in material or equipment furnished by the Contracting Agency, he shall notify the Construction Manager. After such discovery, the Contractor shall not proceed with work involving Contracting Agency-furnished materials and equipment unless authorized by the Construction Manager. Unless otherwise noted or specifically stated, materials and equipment furnished by the Contracting Agency, which are not of local occurrence, are "FOB" railroad or truck terminal nearest to the site of the work. The Contractor shall unload, transport, store, and protect such material and equipment from damage. The Contractor shall inspect such Contracting Agency-furnished material and equipment on receipt and provide the Contracting Agency with written acceptance for the incorporation of said material and equipment into the work. After receipt by the Contractor, at the point of delivery, Contracting Agency-furnished material and equipment shall form part of the work, for purposes of the contract, including risk of loss, as if it had been supplied and stored by the Contractor himself.

Guarantee And Warranty

For a period of 365 days commencing on the date of substantial completion of the work or on the date of possession and use by Kitsap County (but commencing only as to such portions of the work so possessed or used), whichever comes earlier, the Contractor shall, upon the receipt of notice in writing from Kitsap County, promptly correct any defective work. If the defective work cannot be corrected, or if the corrected work has been rejected by Kitsap County, the Contractor shall promptly remove it from the site and replace it with non-defective work, all at no cost to Kitsap County. Kitsap County is hereby authorized to make such corrections if, ten days after giving such notice to the Contractor, the Contractor has failed to make or undertake the corrections or removal/replacement with due diligence. In case of an emergency where, in the opinion of the Director, delay could cause serious loss or damage, corrections or replacement may be made prior to or concurrent with notice being sent to the Contractor. All expenses in connection with such corrections or replacement, including costs for professional services, will be charged to the Contractor. For defective work either corrected or replaced, this guarantee shall be extended for a period equal to the time of correction or replacement.

The guarantee provided in this section shall be in addition to those specific guarantee or warranty requirements for equipment and/or work items indicated in the Specifications, and in addition to any other rights or remedies available to Kitsap County under this Contract or law.

Warrantee Of Title

No material, supplies, equipment or items for the work shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or in any part thereof is retained by the seller or supplier. The Contractor shall warrant good title to all materials, supplies, equipment and items installed or incorporated in the work, and upon completion of all the work shall deliver the same together with all improvements and appurtenances constructed or placed thereon by the Contractor to the Construction Manager free from any claims, liens, or charges. Neither the Contractor nor any person, firm, or corporation furnishing any material or labor for any work covered by this Contract shall have any right to lien upon any improvement or appurtenance thereon. Nothing contained in this, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any bond given by the Contractor for their protection or any rights under any law permitting such persons to look to funds due to the Contractor in the hands of Kitsap County. The provisions of this paragraph shall be inserted or referenced in or otherwise made a part of all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

Claims and Disputes

In the event the Contractor disagrees with any determination or decision of the Construction Manager, the Contractor shall, within 15 days of the date of such determination or decision, appeal the determination or decision in writing to the Sewer Utility Director in accordance with the provisions of this section. Such written notice of appeal shall include all documents and other information necessary to substantiate the appeal. The Director will review the appeal and will transmit a decision in writing to the Contractor within 30 days of the date of receipt of the appeal, or the appeal will be deemed denied on the 30th day. Failure of the Contractor to appeal the decision or determination of the Construction Manager within said 15-day period will constitute a waiver of the Contractor's right to thereafter assert any claim resulting from such determination or decision. Appeal to the Director shall be a condition precedent to litigation.

All claims, counterclaims, disputes and other matters in question between Kitsap County and the Contractor that are not resolved between the Director and the Contractor, or waived, will be decided in the Superior Court of Kitsap County, Washington, which shall have exclusive jurisdiction and venue over all matters in question between Kitsap County and the Contractor. This Contract shall be interpreted and construed in accordance with the laws of the state of Washington.

As a condition precedent to any litigation, for all claims arising under this Contract or arising out of the work under this Contract, the party asserting a claim against the other must in a written notice state the following:

- a. the dollar amount of the claim; and
- b. the specific legal bases and/or contract sections upon which the claim is made.

If in any subsequent legal action, the claiming party recovers less than ninety percent (90%) of the amount claimed, the claiming party shall pay to the other that other party's attorneys' fees, expert witness and consultant fees and all other litigation costs, in such proportion as the difference between the amount claimed and the principal amount recovered bears to the amount claimed. This paragraph shall not apply to claims relating to defective work or guarantees.

No claim for equitable adjustment, extra work or any other claim arising from this Contract will be made by the Contractor or allowed by Kitsap County for the recovery of consequential damages, including (without limitation), lost profits, lost opportunities or the like.

Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the Contract and in accordance with the direction of the Director. Failure to comply precisely with the deadlines for any claim shall operate as a waiver and release of that claim and an acknowledgment of prejudice to Kitsap County.

All Certified Claims filed against the Contracting Agency shall be subject to audit at any time following the filing of the claim. Failure of the Contractor or subcontractors to maintain and retain sufficient records to allow the auditors to verify all or a portion of the claim or to permit the auditor access to the books and records of the Contractor or subcontractors shall constitute a waiver of a claim and shall bar recovery thereunder.

PART 04 LEGAL RESPONSIBILITIES - GENERAL**Employee Safety**

The Contractor shall be responsible for the safety of all workers and shall comply with all appropriate state safety and health standards, codes, rules, and regulations, including, but not limited to, those promulgated under the Washington Industry Safety and Health Act RCW 49.17 (WISHA) and as set forth in Title 296 WAC (Department of Labor and Industries). The Contractor's attention is drawn to the requirements of WAC 296.800 which requires employers to provide a safe workplace. More specifically WAC 296.800.11025 prohibits alcohol and narcotics from the workplace. The Contractor shall likewise be obligated to comply with all federal safety and health standards, codes, rules, and regulations that may be applicable to the Contract Work. A project Health and Safety Plan shall be prepared and submitted in accordance with Section 01 30 00.

Construction Waste Management and Disposal

Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to federal, state, and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project. Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

Use of County waste containers is not permitted.

Hazardous Waste and Materials

The contractor shall comply with all pertinent federal hazardous waste laws and Washington State Dangerous Waste regulations governing hazardous waste generation, storage, transportation, treatment and disposal.

An Asbestos Survey was completed in August 2025 for the areas of construction in the Lab Admin Building at the Central Kitsap Treatment Plant (see Appendix A). Gaskets identified in the boiler room with Asbestos Containing Material will be removed by others prior to construction.

The Contractor shall conduct its work to meet the requirements set forth in the Specifications and any applicable laws or regulations related to hazardous materials encountered during performance of the work. Hazardous materials include asbestos, PCBs, radioactive materials, explosives and other materials deemed as such by regulatory agencies. If the material proves positive as containing asbestos, such

material shall be handled in compliance with WAC 296-62- 077 through 296-62-07753. The Contractor shall give immediate oral notice, and written notice within 1 workday to the Inspector upon the discovery of any such hazardous materials and proceed thereafter only as directed by the Inspector or Construction Manager or as set forth in the specifications.

Permits and Licenses

The Contractor shall obtain all required permits and licenses and give all required notices.

Apply to the Kitsap County Department of Community Development (DCD) for a **commercial mechanical permit**. (If significant structural modifications are to take place, a building permit may also be required.) Online application at: [Prepare, Apply for and Manage Your Permit \(kitsap.gov\)](https://www.kitsap.gov/prepare-apply-for-and-manage-your-permit)

Application will require provision of the following information: a site plan and drawings showing where the units are that are being replaced; specs on the equipment being installing; engineering calculations on load capacity of new equipment if the weight is greater than the old or going in a different place; a Phasing Plan for limited occupancy during tenant improvements (Lab/Admin Bldg). Allow at least eight weeks for plan review and obtaining permits before the installation.

Electrical permit(s) are required and may be obtained through the WA. State Dept. of Labor and Industry.

The Contracting Agency will support the Contractor in efforts to obtain a temporary operating permit in its name if:

1. A local rule or an agency policy prevent issuing the permit to a private firm;
2. The Contractor takes all action to obtain the permit;
3. The permit will serve the public interest;
4. The permit applies only to Work under the Contract;
5. The Contractor agrees in writing: (a) to comply with all the issuing agency requires, and (b) to hold the Contracting Agency harmless for all Work-related liability incurred under the permit; and
6. The permit costs the Contracting Agency nothing.

PART 05 LEGAL RESPONSIBILITIES – WAGES AND BENEFITS**Wages**

This Contract is subject to the minimum wage requirements of RCW 39.12 and to RCW 49.28 (as amended or supplemented). The hourly minimum rates for wages and fringe benefits are listed in the Contract Provisions.

The Contractor, subcontractors, and all individuals or firms required by RCW 39.12, WAC 296-127 shall not pay any worker less than the minimum hourly wage rates and fringe benefits required by RCW 39.12. Higher wages and benefits may be paid.

By including the hourly minimum rates for wages and fringe benefits in the Contract Provisions, the Contracting Agency does not imply that the Contractor will find labor available at those rates. The Contractor shall be responsible for amounts above the minimums that will have to be paid.

The Contractor shall ensure that all firms (all Suppliers, Manufacturers, or Fabricators) that fall under the provisions of RCW 39.12 because of the definition “Contractor” in WAC 296-127-010, complies with all the requirements of RCW 39.12.

The Contractor shall be responsible for compliance with the requirements of the RCW 39.12 by all firms (all subcontractors, Suppliers, Manufacturers, or Fabricators) engaged in a part of the Work necessary to complete this Contract. Therefore, should a violation of this Subsection occur by any firm that is providing Work or materials for completion of this Contract whether directly or indirectly responsible to the Contractor, the Contracting Agency will act against the Contractor, as provided by the provisions of the Contract, to achieve compliance, including but not limited to, withholding payment on the Contract until compliance is achieved.

In the event the Contracting Agency has an error (omissions are not errors) in the listing of the hourly minimum rates for wages and fringe benefits in the Contract Provisions, the Contractor, subcontractors, or other firms that are required to pay prevailing wages, shall be required to pay the rates as determined to be correct by State L&I. A change order will be prepared to ensure that this occurs. The Contracting Agency will reimburse the Contractor for the actual cost to pay the difference between the correct rates and the rates included in the Contract Provisions, subject to the following conditions:

1. The affected firm relied upon the rates included in the Contract Provisions to prepare its Bid and certifies that it did so;
2. The allowable amount of reimbursement will be the difference between the rates listed and rates later determined to be correct plus only appropriate payroll markup the employer must pay, such as social security and other payments the employer must make to the Federal or State Government.

3. The allowable amount of reimbursement may also include some overhead cost, such as, the cost for bond, insurance, and making supplemental payrolls and new checks to the employees because of underpayment for previously performed Work; and

4. Profit will not be an allowable markup.

Firms that anticipated, when they prepared their Bids, paying a rate equal to, or higher than, the correct rate as finally determined will not be eligible for reimbursement.

Workers shall be paid at least the wages printed in the current prevailing wage rates at the time of the bid opening as prepared by the Department of Labor and Industry. A copy of the journey level rates for Kitsap County rates is included in Appendix A and is made a part of the Contract. The Contractor is referred to the Department of Labor and Industries website stated below for information regarding apprentice level rates. Contractor shall be responsible for checking and obtaining any updates or corrections to these wage rates and complying with any modifications prior to bidding. Contractor shall account for increased labor costs in the bid and no additional payment shall be made for increases in the prevailing wage rates for the project's duration. Prevailing wage rates can be obtained from the Industrial Statistician upon request at the following address:

Department of Labor and Industries

Prevailing Wage Office

P.O. Box 44540

Olympia, WA 98504-4540

Telephone: (360) 902-5335

Fax: (360) 902-5300

<http://www.lni.wa.gov/TradesLicensing/PrevWage/WageRates>

Contractors may also contact the Kitsap County Purchasing Office at the contact information contained in the Invitation to Bid to view or obtain a hard copy of the applicable wage rates.

Before payment is made by or on behalf of the Contracting Agency of any sums due under this Contract, the Contractor and each subcontractor shall submit a Statement of Intent to Pay Prevailing Wages and an Affidavit of Wages Paid. It shall be the responsibility of the Contractor to require all subcontractors to complete Affidavits of Wages Paid and to make the proper filing of same.

A fee per each Statement of Intent to Pay Prevailing Wages and Affidavit of Wages Paid is required to accompany each form submitted to the Department of Labor and Industries. The Contractor is responsible for payment of these fees and shall make all applications directly to the Department of Labor and Industries with a copy of all said applications being provided to the Contracting Agency. These fees shall be incidental to and included in the Contract Price.

When employing apprentices, the Contractor shall supply a link or electronic copy of each approved Apprentice Program that shows the ratio of journey level to apprentice workers and the hourly wage rate steps for each craft on a project. Apprentice workers employed for whom an apprenticeship agreement has been registered and approved with the state apprenticeship council must be paid prevailing hourly rate for an apprentice of that trade. Workers not registered shall be a fully qualified journey level worker and therefore paid at the prevailing hourly rate for journey level workers of that trade in accordance with wage provisions.

If labor and management cannot agree on a dispute over the proper prevailing wage rates, the Contractor shall refer the matter to the Director of State L&I. The Director's (or Secretary's) decision shall be final, conclusive, and binding on all parties. In the event of a dispute on proper prevailing wage rates the Contractor shall seek resolution in accordance with WAC 296-127-060.

Wage Documentation

All Statements of Intent to Pay Prevailing Wages, Affidavits of Wages Paid and Certified Payrolls shall be submitted to the Construction Manager using the L&I online Prevailing Wage Intent & Affidavit (PWIA) system.

The Contractor shall submit via the PWIA system the following documents provided by the Industrial Statistician of the Washington State Department of Labor and Industries (State L&I) for themselves and for each firm covered under RCW 39.12 that will or has provided Work and materials for the Contract:

1. The approved "Statement of Intent to Pay Prevailing Wages". The Contracting Agency will make no payment under this Contract for the Work performed until this statement has been approved by State L&I and reviewed by the Construction Manager.
2. The approved "Affidavit of Prevailing Wages Paid". The Contracting Agency will not grant Completion until all approved Affidavit of Wages paid for the Contractor and all subcontractors have been received by the Construction Manager. The Contracting Agency will not release to the Contractor funds retained under RCW 60.28.011 until all the "Affidavit of Prevailing Wages Paid" forms have been approved by State L&I and all the approved forms have been submitted to the Construction Manager for every firm that worked on the Contract.

The Contractor is responsible paying all fees required by State L&I.

Certified payrolls are required to be submitted by the Contractor for themselves and all subcontractors. The Contractor is advised, if payrolls or Affidavits of Prevailing Wages Paid are not supplied, any or all payments may be withheld until compliance is achieved. In addition, failure to provide Statement of Intents, Affidavit of Wages Paid, or payrolls may result in other sanctions as provided by State laws (RCW 39.12.050) and/or Federal regulations (29 CFR 5.12).

Benefits

The Contractor shall make all payments required for unemployment compensation under Title 50 RCW and for industrial insurance and medical aid required under Title 51 RCW. If payments required by Title

50 or Title 51 are not made when due, the Contracting Agency may retain such payments from money due the Contractor and pay the same into the appropriate fund. Such payment will be made only after giving the Contractor 15 days prior written notice of the Contracting Agency's intent to disburse the funds to the Washington State Department of Labor and Industries or Washington State Employment Security Department as applicable.

The payment will be made upon expiration of the 15-calendar day period if no legal action has been commenced to resolve the validity of the claim. If legal action is instituted to determine the validity of the claim prior to the expiration of the 15-day period, the Contracting Agency will hold the funds until determination of the action or written settlement agreement of the appropriate parties. For Work on or adjacent to water, the Contractor shall make the determination as to whether workers are to be covered under the Longshoremen's and Harbor Worker's Compensation Act administered by the U.S. Department of Labor, or the State Industrial Insurance coverage administered by the Washington State Department of Labor and Industries. The Contractor shall include in the various items in the Bid Proposal all costs for payment of unemployment compensation and for providing either or both insurance coverages.

The Contractor will not be entitled to additional payment for: (1) failure to include such costs, or (2) determinations made by the U.S. Department of Labor or the Washington State Department of Labor and Industries regarding the insurance coverage. The Public Works Contract Division of the Washington State Department of Labor and Industries will provide the Contractor with applicable industrial insurance and medical aid classification and premium rates. After receipt of a Revenue Release from the Washington State Department of Revenue, the Contracting Agency will verify through the Department of Labor and Industries that the Contractor is current with respect to the payments of industrial insurance and medical aid premiums.

PART 06 LEGAL RESPONSIBILITIES – NON-DISCRIMINATION AND EEO**Nondiscrimination Authorities**

During the performance of this Contract, the Contractor, for itself, its assignees, and successors in interest agrees to comply with the following nondiscrimination statutes and authorities, including but not limited to:

1. Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination based on race, color, national origin) and C.F.R. Part 21.
2. 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).
3. Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 et. seq.), as amended, (prohibits discrimination based on sex).
4. Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended (prohibits discrimination based on disability); and 49 C.F.R. Part 27.
5. The Age of Discrimination Act of 1975, as amended (42 U.S.C. § 6101 et seq.), (prohibits discrimination based on age).
6. Airport and Airway Improvement Act of 1982, (49 U.S.C. § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex).
7. 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 of Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition and terms “programs or activities” to include all of the program or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not).
8. Titles II and III of the Americans with Disabilities Act, which prohibit discrimination based on 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.F.R. parts 37 and 38.
9. The Federal Aviation Administration’s Nondiscrimination statute (49 U.S.C. § 47123), (prohibits discrimination based on race, color national origin, and sex).

Nondiscrimination Contractual Requirements

1. The Contractor shall maintain a Work site that is free of harassment, humiliation, fear, hostility and intimidation always. Behaviors that violate this requirement include but are not limited to:
 - a. Persistent conduct that is offensive and unwelcome.
 - b. Conduct that is hazing.
 - c. Jokes about race, gender, or sexuality that are offensive.
 - d. Unwelcome, unwanted, rude or offensive conduct or advances of a sexual nature which interferes with a person's ability to perform their job or creates an intimidating, hostile, or offensive work environment.
 - e. Language or conduct that is offensive, threatening, intimidating or hostile based on race, gender, or sexual orientation.
 - f. Repeating rumors about individuals on the Work Site that are harassing or harmful to the individual's reputation.
2. The Contractor shall not discriminate against any employee or applicant for contracted employment because of race, religion, color, national origin, sex, age, marital status, or the presence of any physical, sensory or mental disability.
3. The Contractor shall, in all solicitations or advertisements for employees, state that all qualified applicants will be considered for employment, without regard to race, religion, color, national origin, sex, age, marital status, or the presence of any physical, sensory, or mental disability.
4. The Contractor shall make decisions regarding selection and retention of subcontractors, procurement of materials and equipment and similar actions related to the Contract without regard to race, religion, color, national origin, sex, age, marital status, or the presence of any physical, sensory, or mental disability.
5. The Contractor shall send to each labor union, employment agency, or representative of workers with which the Contractor has a collective bargaining agreement or other contract or understanding, a notice advising the labor union, employment agency or worker's representative, of the Contractor's commitments under this Contract regarding nondiscrimination.
6. The Contractor shall permit access to its books, records and accounts by the Contracting Agency for the purpose of investigating to ascertain compliance with these Specifications. If information required of a Contractor is in the possession of another who fails or refuses to furnish this information, the Contractor shall describe, in writing, what efforts were made to obtain the information.

7. The Contractor shall maintain records with the name and address of each minority/ female worker referred to the Contractor and what action was taken with respect to the referred worker.
8. The Contractor shall notify the Contracting Agency whenever the union with which the Contractor has a collective bargaining agreement has impeded the Contractor's efforts to effect minority/female workforce utilization. This being the case, the Contractor shall show what relief they have sought under such collective bargaining agreements.
9. The Contractor is encouraged to participate in Contracting Agency and Washington State Human Rights Commission approved program(s) designed to train craft-workers for the construction trades.
10. The Contractor shall comply with the following nondiscrimination provisions, and the Contractor shall ensure the nondiscrimination provisions are included in all subcontracts:
 - a. Nondiscrimination Requirement. During the term of this Contract, the Contractor, including all subcontractors, shall not discriminate on the bases enumerated at RCW 49.60.530(3). In addition, the Contractor, including all subcontractors, shall give written notice of this nondiscrimination requirement to any labor organizations with which the Contractor, or subcontractor, has a collective bargaining or other agreement.
 - b. Obligation to Cooperate. The Contractor, including all subcontractors, shall cooperate and comply with any Washington state agency investigation regarding any allegation that the Contractor, including any subcontractor, has engaged in discrimination prohibited by this Contract pursuant to RCW 49.60.530(3).
 - c. Default. Notwithstanding any provision to the contrary, the Contracting Agency may suspend the Contract in accordance with these provisions, upon notice of a failure to participate and cooperate with any state agency investigation into alleged discrimination prohibited by this Contract, pursuant to RCW 49.60.530(3). Any such suspension will remain in place until the Contracting Agency receives notification that Contractor, including any subcontractor, is cooperating with the investigating state agency. In the event the Contractor, or subcontractor, is determined to have engaged in discrimination identified at RCW 49.60.530(3), the Contracting Agency may terminate this Contract in whole or in part in accordance with these provisions and in addition to the sanctions listed, the Contractor, subcontractor, or both, may be referred for debarment as provided in RCW 39.26.200. The Contractor or subcontractor may be given a reasonable time in which to cure this noncompliance, including implementing conditions consistent with any court-ordered injunctive relief or settlement agreement.
 - d. Remedies for Breach. Notwithstanding any provision to the contrary, in the event of Contract termination or suspension for engaging in discrimination, the Contractor, subcontractor, or both, shall be liable for contract damages as authorized by law including, but not limited to, any cost difference between the original contract and the replacement or cover contract and all administrative costs directly related to the replacement contract, which damages are distinct from

any penalties imposed under Chapter 49.60, RCW. The Contracting Agency shall have the right to deduct from any monies due to Contractor or subcontractor, or that thereafter become due, an amount for damages Contractor or subcontractor will owe Contracting Agency for default under this Provision.

Equal Employment Opportunity (EEO) Responsibilities

During the performance of this Contract, the Contractor, for itself, its assignees and successors in interest (hereinafter referred to as the “Contractor”) agrees as follows:

1. Compliance With Regulations – The Contractor (hereinafter includes consultants) shall comply with the Regulations relative to nondiscrimination in federally assisted programs of the U.S. Department of Transportation (hereinafter DOT), Federal Highway Administration (FHWA), as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this Contract.
2. Nondiscrimination – The Contractor, regarding the Work performed by it during the Contract, shall not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The Contractor shall not participate directly or indirectly in the discrimination prohibited by Acts and Regulations, including employment practices when the Contract covers any activity, project or program set forth in Appendix B of 49 CFR Part 21.
3. Solicitations for Subcontracts, Including Procurement of Materials and Equipment – In all solicitations either by competitive bidding or negotiations made by the Contractor for Work to be performed under a subcontract, including procurement of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the Contractor of the Contractor’s obligations under this Contract and the Acts and Regulations relative to nondiscrimination on the ground of race, color, or national origin.
4. Information and Reports – The Contractor shall provide all information and reports required by the Acts and Regulations or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Washington State Department of Transportation or the Federal Highway Administration to be pertinent to ascertain compliance with such Acts, Regulations and instructions. Where any information required of a Contractor is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the Washington State Department of Transportation, or the Federal Highway Administration as appropriate, and shall 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 nondiscrimination provisions of this Contract, the Washington State Department of Transportation shall impose such Contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to: a. Withholding of payments to the Contractor under the Contract until the Contractor complies, and/or; b. Cancellation, termination, or suspension of the Contract, in whole or in part.

6. Incorporation of Provisions – The Contractor shall include the provisions of paragraphs (1) through (6) in every subcontract, including procurement of materials and leases of equipment, unless exempt by the Acts and Regulations, or directives issued pursuant thereto. The Contractor shall take such action with respect to any subcontractor or procurement as the Washington State Department of Transportation or the Federal Highway Administration 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 with a subcontractor or supplier because of such direction, the Contractor may request the Washington State Department of Transportation to enter any litigation to protect the interests of the Washington State Department of Transportation. In addition, the Contractor may request the United States to enter such litigation to protect the interests of the United States.

The Contractor shall officially designate and make known to the Construction Manager during the preconstruction conference and discussions the firm’s Equal Employment Opportunity Officer (hereinafter referred to as the EEO Officer). The EEO Officer will also be responsible for making him/herself known to each of the Contractor’s employees. The EEO Officer must possess the responsibility, authority, and capability for administering and promoting an active and effective Contractor program of equal employment opportunity.

All members of the Contractor’s staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, shall be made fully cognizant of, and shall implement the Contractor’s equal employment opportunity policy and contractual responsibilities to provide equal employment opportunity in each grade and classification of employment. To ensure that the above agreement is met, the following actions shall be taken as a minimum:

1. EEO Meetings – Periodic meetings of supervisory and personnel office employees shall be conducted before the start of Work and then not less often than once every 6 months, at which time the Contractor’s equal employment opportunity policy and its implementation shall be reviewed and explained. The meetings shall be conducted by the EEO Officer or other knowledgeable company official.
2. EEO Indoctrination – All new supervisory or personnel office employees shall be given a thorough indoctrination by the EEO Officer or other knowledgeable company official covering all

major aspects of the Contractor's equal employment opportunity obligations within 30 days following their reporting for duty with the Contractor.

3. Internal EEO Procedures – All personnel who are engaged in direct recruitment for the project shall be instructed by the EEO Officer or appropriate company official in the Contractor's procedures for locating and hiring minority group and female employees.

To make the Contractor's equal employment opportunity policy known to all employees, prospective employees, and potential sources of employees, e.g., schools, employment agencies, labor unions (where appropriate), college placement officers, and community organizations, the Contractor shall take the following actions:

1. Notices and Posters – Notices and posters setting forth the Contractor's equal employment opportunity policy shall be placed in areas readily accessible to employees, applicants for employment, and potential employees.
2. EEO Indoctrination – The Contractor's equal employment opportunity policy and the procedures to implement such policy shall be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

In the event the Contractor is found in noncompliance with these provisions, the Contracting Agency may impose such Contract sanctions as it or the Federal Highway Administration may determine necessary to gain compliance including, but not limited to:

1. Progress payment requests may not be honored until the noncompliance is remedied to the satisfaction of the Contracting Agency.
2. The Contract may be suspended, in whole or in part, until such time as the Contractor is determined to comply by the Contracting Agency.
3. The Contractor's pre-qualification may be suspended or revoked pursuant to WAC 468-16. The Contracting Agency may refer the matter to the Federal Highway Administration (FHWA) for possible federal sanctions.
4. The Contract may be terminated. Immediately upon the Construction Manager's request, the Contractor shall remove from the Work site any employee engaging in behaviors that promote harassment, humiliation, fear or intimidation including but not limited to those described in these specifications.

The Contractor shall include these provisions in every subcontract including procurement of materials and leases of equipment. The Contractor shall take such action or enforce sanctions with respect to a subcontractor or supplier as the Contracting Agency or the FHWA may direct as a means of enforcing such provisions. In the event a Contractor becomes involved in litigation with a subcontractor or supplier because of such direction, the Contractor may request the Contracting Agency enter such litigation to

protect their interests and the Contracting Agency may request the federal government to enter such litigation to protect the interests of the United States.

The Contractor shall notify all potential Subcontractors and suppliers of the EEO obligations required by the Contract. The Contractor shall use their efforts to ensure subcontractor's compliance with their equal employment opportunity obligations.

The Contractor shall keep such records as are necessary to determine compliance with the Contractor's equal employment opportunity obligations. The records kept by the Contractor shall be designated to indicate:

1. Work Force Data – The number of minority and nonminority group members and women employed in each work classification on the project.
2. Good Faith Efforts – Unions – The progress and efforts being made in cooperation with unions to increase employment opportunities for minorities and women (applicable only to contractors who rely in whole or in part on unions as a source of their work force).
3. Good Faith Efforts – Recruitment – The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees.
4. Subcontracting – The progress and efforts being made in securing the services of disadvantaged, minority, and women subcontractors or subcontractors with meaningful minority and female representation among their employees.

All records must be retained by the Contractor for a period of three years following acceptance of the Contract Work.

Posting Notices for Employees

Notices and posters shall be placed in areas readily accessible to read by employees. The Contractor shall ensure the most current edition of the following are posted:

1. WHD 1088 – **Employee Rights Under the Fair Labor Standards Act** published by US Department of Labor. Post on all projects.
2. WHD 1420 – **Employee Rights and Responsibilities Under the Family and Medical Leave Act** published by US Department of Labor. Post on all projects.
3. WHD 1462 – **Employee Polygraph Protection Act** published by US Department of Labor. Post on all projects.
4. F416-081-909 – **Job Safety and Health Law** published by Washington State Department of Labor and Industries. Post on all projects.
5. F242-191-909 – **Notice to Employees** published by Washington State Department of Labor and Industries. Post on all projects.

6. F700-074-000 – **Your Rights as a Worker in Washington State** by Washington State Department of Labor and Industries (L&I). Post on all projects.
7. EMS 9874 – **Unemployment Benefits** published by Washington State Employment Security Department. Post on all projects.
8. Post one copy of the approved “Statement of Intent to Pay Prevailing Wages” for the Contractor, each subcontractor, and other firms (Suppliers, Manufacturers, or Fabricators) that fall under the provisions of RCW 39.12 because of the definition of “Contractor” in WAC 296-127-010.
9. Post one copy of the prevailing wage rates for the project.

PART 07 LEGAL RESPONSIBILITIES – LIABILITY AND INSURANCE**Liability of Contractor**

Officers and employees of the Contracting Agency will not be responsible in any manner: for losses or damage that may happen to the Work or any part; for losses of material or damage to any of the materials or other things used or employed in the performance of Work; for injury to or death of either workers or the public; or for damage to the public for causes which might have been prevented by the Contractor, or the workers, or anyone employed by the Contractor.

The Contractor shall be responsible for all liability imposed by law for injuries to, or the death of, any persons or damages to property resulting from any cause whatsoever during the performance of the Work, or before final acceptance.

Subject to the limitations in this section, and RCW 4.24.115, the Contractor shall indemnify, defend, and save harmless all officers and employees of the Contracting Agency from all claims, suits, or actions brought for injuries to, or death of, any persons or damages resulting from construction of the Work or in consequence of any negligence or breach of Contract regarding the Work, the use of improper materials in the Work, caused in whole or in part by an act or omission by the Contractor or the agents or employees of the Contractor during performance or at any time before final acceptance. In addition to a remedy authorized by law, the Contracting Agency may retain so much of the money due the Contractor as deemed necessary by the Construction Manager to ensure the defense and indemnification obligations of this section until disposition has been made of such suits or claims.

Pursuant to RCW 4.24.115, if such claims, suits, or actions result from the concurrent negligence of (a) the indemnitee or the indemnitee's agents or employees and (b) the Contractor or the Contractor's agent or employees, the indemnity provisions provided in the preceding paragraphs of this section shall be valid and enforceable only to the extent of the Contractor's negligence or the negligence of its agents and employees.

The Contractor shall bear sole responsibility for damage to completed portions of the project and to property located off the project caused by erosion, siltation, runoff, or other related items during the construction of the project. The Contractor shall also bear sole responsibility for any pollution of rivers, streams, ground water, or other waters that may occur because of construction operations.

The Contractor shall exercise all necessary precautions throughout the life of the Project to prevent pollution, erosion, siltation, and damage to property.

The Contracting Agency will forward to the Contractor all claims filed against the State according to RCW 4.92.100 that are deemed to have arisen in relation to the Contractor's Work or activities under this Contract, and, in the opinion of the Contracting Agency, are subject to the defense, indemnity, and insurance provisions of these Specifications. Claims will be deemed tendered to the Contractor and insurer, who has named the State as a named insured or an additional insured under the Contract's

insurance provisions, once the claim has been forwarded via email with delivery confirmation to the Contractor. The Contractor shall be responsible to provide a copy of the claim to the Contractor's designated insurance agent who has obtained/met the Contract's insurance provision requirements.

Within 60 calendar days following the date a claim is sent by the Contracting Agency to the Contractor, the Contractor shall notify both the Claimant as specified on the Claimant's contact information and the Contracting Agency by responding to the tendering email:

- a. Whether the claim is allowed or is denied in whole or in part, and, if so, the specific reasons for the denial of the individual claim, and if not denied in full, when payment has been or will be made to the claimant(s) for the portion of the claim that is allowed, or
- b. If resolution negotiations are continuing. In this event, status updates will be reported no longer than every 60 calendar days until the claim is resolved, or a lawsuit is filed.

If the Contractor fails to provide the above notification within 60 calendar days, then the Contractor shall yield to the Contracting Agency sole and exclusive discretion to allow all or part of the claim on behalf of the Contractor, and the Contractor shall be deemed to have WAIVED any and all defenses, objections, or other avoidances to the Contracting Agency's allowance of the claim, or the amount allowed by the Contracting Agency, under common law, constitution, statute, or the Contract and these Standard Specifications. If all or part of a claim is allowed, the Contracting Agency will notify the Contractor via email with delivery confirmation that it has allowed all or part of the claim and make appropriate payments to the claimant(s) with State funds.

Payments of State funds by the Contracting Agency to claimant(s) under this section will be made on behalf of the Contractor and at the expense of the Contractor, and the Contractor shall be unconditionally obligated to reimburse the Contracting Agency for the "total reimbursement amount", which is the sum of the amount paid to the claimant(s), plus all costs incurred by the Contracting Agency in evaluating the circumstances surrounding the claim, the allowance of the claim, the amount due to the claimant, and all other direct costs for the Contracting Agency's administration and payment of the claim on the Contractor's behalf. The Contracting Agency will be authorized to withhold the total reimbursement amount from amounts due the Contractor, or, if no further payments are to be made to the Contractor under the Contract, the Contractor shall directly reimburse the Contracting Agency for the amounts paid within 30 days of the date notice that the claim was allowed was sent to the Contractor. In the event reimbursement from the Contractor is not received by the Contracting Agency within 30 days, interest shall accrue on the total reimbursement amount owing at the rate of 12 percent per annum calculated at a daily rate from the date the Contractor was notified that the claim was allowed. The Contracting Agency's costs to enforce recovery of these amounts are additive to the amounts owing.

The Contractor specifically assumes all potential liability for actions brought by employees of the Contractor and, solely for the purpose of enforcing the defense and indemnification obligations set forth in these provisions, the Contractor specifically waives immunity granted under the State industrial

insurance law, Title 51 RCW. This waiver has been mutually negotiated by the parties. The Contractor shall similarly require that each subcontractor it retains in connection with the project comply with the terms of this paragraph, waive any immunity granted under Title 51 RCW, and assume all liability for actions brought by employees of the subcontractor.

The Contractor shall protect, defend, indemnify, and save harmless the Contracting Agency, its officers, officials, employees, agents, and Construction Manager from any and all claims, demands, suits, penalties, losses, damages, judgments, or costs of any kind whatsoever (hereinafter "claims"), arising out of or in any way resulting from the Contractor's officers, employees, agents, and/or subcontractors of all tiers, acts or omissions, performance or failure to perform this Contract, to the maximum extent permitted by law or as defined by RCW 4.24.115, now enacted or as hereinafter amended.

The Contractor's obligations under this section shall include, but not be limited to:

1. The duty to promptly accept tender of defense and provide defense to the Contracting Agency at the Contractor's own expense.
2. The duty to indemnify and defend the Contracting Agency and Construction Manager from any claim, demand, and/or cause of action brought by or on behalf of any of its employees, or agents. The foregoing duty is specifically and expressly intended to constitute a waiver of the Contractor's immunity under Washington's Industrial Insurance Act, RCW Title 51, as respects the Contracting Agency with a full and complete indemnity and defense of claims made by the Contractor's employees. The parties acknowledge that these provisions were mutually negotiated and agreed upon by them.
3. To the maximum extent permitted by law, the Contractor shall indemnify and defend the Contracting Agency and Construction Manager from and be liable for all damages and injury which shall be caused to owners of property on or in the vicinity of the work or which shall occur to any person or persons or property whatsoever arising out of the performance of this Contract, whether or not such injury or damage is caused by negligence of the Contractor or caused by the inherent nature of the work specified.

The Contracting Agency may, in its sole discretion, withhold amounts sufficient to pay the amount of any claim for injury, and/or pay any claim for injury of which the Contracting Agency may have knowledge, regardless of the formalities of notice of such claim, arising out of the performance of this Contract.

An amount withheld will be held until the Contractor secures a written release from the claimant, obtains a court decision that such claim is without merit, or satisfies any judgment on such claim. In addition, the Contractor shall reimburse and otherwise be liable for claims costs incurred by the Contracting Agency, including, without limitation, costs for claims adjusting services, attorneys, engineering, and administration.

In the event the Contracting Agency incurs any judgment, award, and/or costs arising, including attorneys' fees, from enforcing the provisions of this provision, all such fees, expenses, and costs shall be recoverable from the Contractor.

Bonds

The successful bidder shall provide executed payment and performance bond(s) for the full contract amount. The bond may be a combined payment and performance bond; or be separate payment and performance bonds. In the case of separate payment and performance bonds, each shall be for the full contract amount. The bond(s) shall:

1. Be on Contracting Agency-furnished form(s);
2. Be signed by an approved surety (or sureties) that:
 - a. Is registered with the Washington State Insurance Commissioner, and
 - b. Appears on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner,
 - c. Have a minimum A.M. Best financial strength rating minimum rating of A- or higher;
3. Guarantee that the Contractor will perform and comply with all obligations, duties, and conditions under the Contract, including but not limited to the duty and obligation to indemnify, defend, and protect the Contracting Agency against all losses and claims related directly or indirectly from any failure:
 - a. Of the Contractor (or any of the employees, subcontractors, or lower tier subcontractors of the Contractor) to faithfully perform and comply with all contract obligations, conditions, and duties, or
 - b. Of the Contractor (or the subcontractors or lower tier subcontractors of the Contractor) 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.
4. Be conditioned upon the payment of taxes, increases, and penalties incurred on the project under titles 50, 51, and 82 RCW; and
5. Be accompanied by a power of attorney for the Surety's officer empowered to sign the bond; and
6. Be signed by an officer of the Contractor empowered to sign official statements (sole proprietor or partner). If the Contractor is a corporation, the bond(s) must be signed by the president or vice president, unless accompanied by written proof of the authority of the individual signing the bond(s) to bind the corporation (i.e., corporate resolution, power of attorney, or a letter to such effect signed by the president or vice president).

The Contracting Agency may require Sureties or Surety companies on the Contract Bond to appear and qualify themselves. Whenever the Contracting Agency deems the Surety or Sureties to be inadequate, it may, upon written demand, require the Contractor to furnish additional Surety to cover all remaining Work. Until the added Surety is furnished, payments on the Contract will stop.

Insurance

The Contractor shall obtain the insurance described in this section from insurers that are licensed to do business in the state of Washington with a rating of A- or higher in the A.M. Best's Key Rating Guide. The Contracting Agency reserves the right to approve or reject the insurance provided, based on the insurer (including financial condition), terms and coverage, the Certificate of Insurance, and/or endorsements.

The Contractor's insurance shall apply separately to each insured against whom a claim is made, or suit is brought, except with respect to the limits of the insurer's liability.

The insurance limits mandated for any insurance coverage required by this Contract are not intended to be an indication of exposure nor are they limitations on indemnification.

The Contractor shall keep this insurance in force during the term of the contract and for thirty (30) days after the Physical Completion date, unless otherwise indicated. Certificates, policies, and endorsements expiring before completion of services shall be promptly replaced as well as the verification sent to the Contracting Agency.

If any insurance policy is written on a claims-made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract. The policy shall state that coverage is claims made and state the retroactive date. Claims-made form coverage shall be maintained by the Contractor for a minimum of 36 months following the Final Completion or earlier termination of this contract, and the Contractor shall annually provide the Contracting Agency with proof of renewal. If renewal of the claims made form of coverage becomes unavailable, or economically prohibitive, the Contractor shall purchase an extended reporting period ("tail") or execute another form of guarantee acceptable to the Contracting Agency to assure financial responsibility for liability for services performed.

The insurance policies shall contain a "cross liability" or "separation of insureds" provision.

The Contractor's and all subcontractors' insurance coverage shall be primary and non-contributory insurance as respects the Contracting Agency's insurance, self-insurance, or insurance pool coverage.

The Contractor shall provide written notice to the Contracting Agency and all Additional Insureds of

any policy cancellation, expiration, or material reduction in coverage within two (2) business days of the Contractor's receipt of such notice.

Written notice of any cancellations or changes in coverage shall be mailed to the Contracting Agency at the following address:

Attn: Risk Manager
Department of Administrative Services
614 Division Street
Port Orchard, Washington 98366

Upon request, the Contractor shall forward to the Contracting Agency a full and certified copy of the insurance policy(s). The Contractor shall not begin work under the contract until the required insurance has been obtained and approved by the Contracting Agency.

Failure on the part of the Contractor to maintain the insurance as required shall constitute a material breach of contract, upon which the Contracting Agency may, after giving five business days' notice to the Contractor to correct the breach, immediately terminate the contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the Contracting Agency on demand, or at the sole discretion of the Contracting Agency, offset against funds due the Contractor from the Contracting Agency.

All costs for insurance shall be incidental to and included in the unit or lump sum prices of the contract and no additional payment will be made.

Additional Insured

All insurance policies, except for Professional Liability and Workers Compensation, shall name the following listed entities as additional insured(s) with respect to performance of services:

1. Kitsap County and its officers, elected officials, employees, agents, and volunteers;

2. The County's consultant, FSI Engineers and its subconsultants:
 - a. Rolluda Architects
 - b. BHC Consultants

3. The Contracting Agency's Special Inspection and Testing consultant.

The above-listed entities shall be additional insureds for the full available limits of liability maintained by the Contractor, whether primary, excess, contingent or otherwise, irrespective of whether such limits maintained by the Contractor are greater than those required by this Contract, and irrespective of whether the Certificate of Insurance provided by the Contractor describes limits

lower than those maintained by the Contractor.

A failure to comply with reporting provisions of the policies shall not affect coverage provided to the above-mentioned entities.

Subcontractors

Contractor shall ensure that each subcontractor of every tier obtains and maintains at a minimum the insurance coverages listed herein. Upon request of the Contracting Agency, the Contractor shall provide evidence of such insurance.

Evidence of Insurance

The Contractor shall deliver to the Contracting Agency a properly executed Certificate(s) of Insurance and/or signed policy endorsements for each policy of insurance meeting the requirements set forth herein when the Contractor delivers the signed Contract for the work. The certificate and endorsements must conform to the following requirements:

1. An ACORD certificate or a form determined by the Contracting Agency to be equivalent.
2. Copies of all endorsements naming Contracting Agency and all other entities listed in in these provisions as Additional Insured(s), showing the policy number. The Contractor may submit a copy of any blanket additional insured clause from its policies instead of a separate endorsement. A statement of additional insured status on an ACORD Certificate of Insurance shall not satisfy this requirement.
3. Any other amendatory endorsements to show the coverage required herein.
4. Certificates of Insurance shall show the Certificate Holder as Kitsap County and include c/o of the Office or Department issuing the Contract. The address of the Certificate Holder shall be shown as the current address of the Office or Department.

Coverages and Limits**Commercial General Liability**

Contractor shall maintain a policy of Commercial General Liability Insurance, including:

1. Per project aggregate
2. Premises/Operations Liability
3. Products/Completed Operations – for one year following final acceptance of the work.
4. Personal/Bodily/Advertising Injury
5. Property damage
6. Contractual Liability

- 7. Independent Contractors Liability
- 8. Stop Gap / Employers' Liability

Such policy must provide the following minimum limits:

- \$2,000,000 Each Occurrence
- \$5,000,000 General Aggregate
- \$4,000,000 Products & Completed Operations Aggregate
- \$2,000,000 Personal, Bodily, & Advertising Injury, each offence

Stop Gap / Employers' Liability

- \$1,000,000 Each Accident
- \$1,000,000 Disease - Policy Limit
- \$1,000,000 Disease - Each Employee

The Commercial General Liability coverage shall not exclude any activity to be performed in fulfillment of this Contract and shall contain no special limitations on the scope of protection afforded any additional insured(s). Specialized forms specific to the industry of the Contractor will be deemed equivalent provided coverage is no more restrictive than would be provided under a standard Commercial General Liability policy, including contractual liability coverage. Coverage shall include liability arising out of activities performed by or on behalf of the Contractor; products and completed operations of the Contractor; or premises owned, leased, or used by the Contractor.

Automobile Liability

Automobile Liability for owned, non-owned, hired, and leased vehicles, with an MCS 90 endorsement and a CA 9948 endorsement attached if "pollutants" are to be transported. Such policy(ies) must provide the following minimum limit:

- \$1,000,000 combined single limit per occurrence for Bodily Injury and Property Damage

Workers Compensation:

The Contractor shall comply with Workers' Compensation coverage as required by the Industrial Insurance laws of the state of Washington. Contractor shall also maintain Employees Liability Coverage with a limit of not less than \$1 million. Contractor shall provide evidence of all coverage to the Contracting Agency.

Contractor shall request that their Washington State Department of Labor and Industries, Workers Compensation Representative send written verification to Kitsap County, within ten (10) calendar days after the effective date of the Contract, that the Contractor is currently paying Workers Compensation.

Builders Risk:

Contractor shall purchase and maintain Builder’s Risk insurance covering interests of the Contracting Agency, the Contractor, and Subcontractors of every tier, as Named Insureds, in the Work. An Installation Floater instead of Builders Risk is acceptable for renovation projects. Builder’s Risk insurance shall be on a special form policy and shall insure against the perils of fire and extended coverage and physical loss or damage, theft, vandalism, malicious mischief, and collapse; and flood and earthquake when shown below. The Builder’s Risk insurance shall include coverage for temporary buildings, debris removal, and damage to materials in transit or stored off-site. Such insurance shall cover resulting “soft costs” including but not limited to design costs, licensing fees, architect’s and Construction Manager’s fees, and costs due to delay in completion.

Builder’s Risk insurance shall be written in the amount of the completed value of the project, with no coinsurance provisions. Such policy must provide coverage and deductibles that comply with the following:

Coverage:

Total Cost of Project to be Insured: Contractor Bid Price

Soft Costs: \$2,000,000

Flood: \$2,000,000

Earthquake: \$3,000,000

Deductibles not to exceed:

Earthquake and Flood: 5% of the Value at Time of Loss, subject to a \$250,000 Minimum

Earth Movement: 5% of the Value at Time of Loss, subject to a \$250,000 Minimum

All Other Perils: \$50,000

Soft Costs: \$50,000, with no more than 7-day waiting period

The Builders Risk insurance covering the work shall have maximum deductibles as listed above for each occurrence. The deductible(s) shall be the responsibility of the Contractor.

The Contractor shall provide the Contracting Agency with a full and certified copy of the insurance policy when the Contractor delivers the signed Contract for the work. Failure of Contracting Agency to demand such verification of coverage with these insurance requirements or failure of Contracting Agency to identify a deficiency from the insurance documentation provided shall not be construed as a waiver of Contractor’s obligation to maintain such insurance.

The Builders Risk insurance shall be maintained until final acceptance of the Work by the Contracting Agency.

The Contractor and the Contracting Agency waive all rights against each other and any of their Subcontractors of every tier, agents, and employees, officers, and officials, for damages caused by fire or other perils to the extent covered by Builder's Risk insurance or other property insurance applicable to the work. The policies shall provide such waivers by endorsement.

Excess or Umbrella Liability

The Contractor shall provide Excess or Umbrella Liability insurance with limits of not less than 1 million each occurrence and annual aggregate. This excess or umbrella liability coverage shall be more than and at least as broad in coverage as the Contractor's Commercial General and Auto Liability insurance.

All entities listed under these contract provisions shall be named as additional insureds on the Contractor's Excess or Umbrella Liability insurance policy.

This requirement may be satisfied instead through the Contractor's primary Commercial General and Automobile Liability coverages, or any combination thereof that achieves the overall required limits of insurance.

Pollution Liability

The Contractor shall provide a Contractors Pollution Liability policy, providing coverage for claims involving bodily injury, property damage (including loss of use of tangible property that has not been physically injured), cleanup costs, remediation, disposal, or other handling of pollutants, including costs and expenses incurred in the investigation, defense, or settlement of claims arising out of:

1. Contractor's operations related to this project; and/or
2. Remediation, abatement, repair, maintenance or other work with lead-based paint or materials containing asbestos; and/or
3. Transportation of hazardous materials away from any site related to this project.

All entities listed in this section as additional insureds shall be named by endorsement as additional insureds on the Contractors Pollution Liability insurance policy.

Such Pollution Liability policy shall provide the following minimum coverage:

\$2,000,000 each loss and annual aggregate

This policy shall be endorsed so that "pollutants" definition includes sewage and/or reclaimed water as well as any sewage and/or reclaimed water byproducts. The policy shall also include property damage coverall for natural resource damages (NRD).

PART 08 PROSECUTION AND PROGRESS**Notice To Proceed**

Notice to Proceed will be given after the contract has been executed and the contract bond and evidence of insurance have been approved and filed by the Contracting Agency. Contractor shall not commence with the work until the Notice to Proceed has been given by the Contracting Agency. Contractor shall commence construction activities on the project site within ten days of the Notice to Proceed Date, unless otherwise approved in writing. Contractor shall diligently pursue the work to the physical completion date within the time specified in the contract. Voluntary shutdown or slowing of operations by Contractor shall not relieve Contractor of the responsibility to complete the work within the time(s) specified in the contract.

Construction Progress:

The Contractor shall furnish such manpower, materials, facilities and equipment as may be necessary to insure the prosecution and completion of the work in accordance with the accepted schedule. If work falls 14 days or more behind the accepted construction schedule, the Contractor agrees that he will take some or all the following actions to return the project to the accepted schedule. These actions may include the following:

1. Increase manpower in quantities and crafts.
2. Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of equipment, or any combination of the foregoing.
3. Reschedule activities.

If requested by the Construction Manager, the Contractor shall prepare a proposed schedule revision demonstrating a plan to make up the lag in progress and insure completion of the work within the contract time.

Construction Schedule:

The Contractor shall provide a construction schedule and reports as specified in Section 01 32 16 for scheduling and coordinating the work within the contract time. Contract time extensions shall be incorporated into updated schedules, reflecting their effect at the time of occurrence.

Time for Completion

The Contractor shall complete all physical Contract Work within the number of “working days” stated in the Contract Provisions or as extended by the Construction Manager. Every day will be counted as a “working

day” unless it is a nonworking day, or a Construction Manager determined unworkable day. A nonworking day is defined as a Saturday, a Sunday, a whole or half day on which the Contract specifically prohibits Work on the critical path of the Contractor’s approved progress schedule, or one of these holidays: January 1, the third Monday of January, the third Monday of February, Memorial Day, June 19, July 4, Labor Day, November 11, Thanksgiving Day, the day after Thanksgiving, and Christmas Day. When any of these holidays fall on a Sunday, the following Monday shall be counted as a nonworking day. When the holiday falls on a Saturday, the preceding Friday shall be counted as a non-working day. The days between December 25 and January 1 will be classified as nonworking days. If Contractor performs work on a day that is classified as a non-working day, then that day shall be reclassified as a working day and counted towards the Contract time.

An unworkable day is defined as a half or whole day the Construction Manager declares to be unworkable because of weather or conditions caused by the weather that prevent satisfactory and timely performance of the Work shown on the critical path of the Contractor’s approved progress schedule. Other conditions beyond the control of the Contractor may qualify for an extension of time.

Contract time for the Preconstruction Phase Work shall begin on the working day identified in the Limited Notice to Proceed. Each working day shall be charged to the contract as it occurs, until the Preconstruction Phase work is physically complete.

Contract time for the Construction Phase Work shall begin on the working day identified in the Notice to Proceed with Construction. Each working day shall be charged to the contract as it occurs, until the Construction Phase contract work is physically complete.

The Contracting Agency will give the Contractor written notice of the completion date of the contract after all the Contractor’s obligations under the contract have been performed by the Contractor. The following events must occur prior to establishing the Completion Date:

1. The physical work on the project must be complete; and
2. The Contractor must furnish all documentation required by the contract and required by law, to allow the Contracting Agency to process final acceptance of the contract. The following documents must be received by the Contracting Agency prior to establishing a completion date:
 - a. Final Contract Voucher Certification
 - b. Copies of the approved "Affidavit of Prevailing Wages Paid" for the Contractor and all Subcontractors.
 - c. Property owner releases
 - d. A copy of the Notice of Termination sent to the Washington State Department of Ecology (Ecology); the elapse of 30 calendar days from the date of receipt of the Notice of Termination by Ecology; and no rejection of the Notice of Termination by Ecology. This requirement will not apply if the Construction Stormwater General Permit is transferred back to the Contracting Agency

The project has the following critical completion date milestones:

1. Completion of Preconstruction Phase Work. All work under the Preconstruction Phase of this Contract shall be completed within 45 working days after the Limited Notice to Proceed date.
2. Substantial Completion. All work under this Contract shall be substantially complete within 90 working days after the Notice to Proceed w/Construction date.
3. Physical Completion. All work under this Contract shall be physically complete within 100 working days after the Notice to Proceed w/Construction date.

Liquidated damages will be applied to any working days that exceed the time frames stipulated above

For each day determined to be abnormal weather as determined by the Construction Manager and approved by the Contracting Agency, one day shall be added to the contract duration at no additional cost to the Contracting Agency by written change order. Precipitation such as rain, hail or snow, low temperature, windstorm, ice, snow and other weather conditions which could reasonably have been anticipated from the National Weather Service historical records of the general locality of the work shall not be construed as abnormal. It is hereby agreed that temperatures less than the following, and wind velocities greater than the following, cannot be reasonably anticipated.

- A. Daily maximum temperature equal to, or less than, 20 degrees F during a week when the maximum daily temperature never exceeds 35 degrees F.
- B. Daily maximum temperature equal to, or less than, 15 degrees F at any time.
- C. Daily maximum wind velocity equal to or greater than 50 mph at any time.

Ice, snow and other weather conditions may be considered as abnormal in the sole discretion of the Construction Manager upon written request by the Contractor. Such written request shall describe in detail the weather condition, identify the specific impacts resulting from the weather condition, and be submitted to the Construction Manager within five days of the onset of the weather condition. The Contractor shall provide, install, and maintain a project-dedicated, Wi-Fi-enabled weather monitoring station capable of continuously measuring and automatically logging daily maximum and minimum air temperature, wind speed, and rainfall. Weather data shall be transmitted to a secure, web-based platform with unrestricted access for County and Contractor personnel and shall allow viewing and export of historical daily records. The weather monitoring station shall be a professional-grade system intended for commercial or construction use, and consumer-grade or residential weather stations shall not be acceptable. The weather station shall be installed during the Preconstruction phase of the Work, shall remain in continuous operation until Physical Completion, and shall be turned over to the Owner at Project

Completion, and shall be installed, operated, and maintained in accordance with the manufacturer's requirements to ensure accurate and representative site-specific measurements.

Delays

When the Contractor foresees a delay in the prosecution of the work and, in any event, immediately upon the occurrence of a delay which the Contractor regards as unavoidable, he shall notify the Construction Manager in writing of the probability of the occurrence of such delay, the extent of the delay, and its possible cause. The Contractor shall take immediate steps to prevent, if possible, the occurrence or continuance of the delay. If this cannot be done, the Construction Manager shall determine how long the delay shall continue and to what extent the prosecution and completion of the work are being delayed thereby. He shall also determine whether the delay is to be considered avoidable or unavoidable and shall notify the Contractor of his determination. The Contractor agrees that no claim shall be made for delays which are not called to the attention of the Construction Manager at the time of their occurrence.

Unavoidable delays in the prosecution or completion of the work shall include delays which result from causes beyond the control of the Contractor, and which could not have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor or his subcontractors. Delays in completion of the work of other contractors employed by the Contracting Agency will be considered unavoidable delays insofar as they interfere with the Contractor's completion of the work. Delays due to normal weather conditions shall not be regarded as unavoidable as the Contractor agrees to plan his work with prudent allowances for interference by normal weather conditions. Delays caused by acts of God, fire, unusual storms, floods, tidal waves, earthquakes, strikes, labor disputes, freight embargoes and shortages of materials shall be considered as unavoidable delays insofar as they prevent the Contractor from proceeding with at least seventy-five percent (75%) of the normal labor and equipment force for at least five hours per day toward completion of the current controlling item on the accepted critical path schedule.

Should abnormal conditions prevent the work from beginning at the usual starting time, or prevent the Contractor from proceeding with seventy-five percent (75%) of the normal labor and equipment force for a period of at least five hours per day, and the crew is dismissed as a result thereof, he will not be charged for a working day whether or not conditions change so that the major portion of the day could be considered to be suitable for work on the controlling item.

Extensions Of Time

The Contractor shall submit requests for time extensions to the Construction Manager in writing no later than 14 calendar days after the delay occurs. No adjustment shall be allowed for contract time incurred more than 14 calendar days prior to the date the Construction Manager receives the Contractor's written request of time

extension. The requests for time extension shall be limited to the effect on the critical path of the Contractor's approved schedule attributable to the change or event giving rise to the request.

The Construction Manager may request additional information regarding the request, to ascertain the basis and amount of the time requested. In addition, the Construction Manager may request, and the Contractor shall provide within 14 calendar days after Construction Manager's request, an updated schedule that supports the request and demonstrates that the change or event: (1) had a specific impact on the critical path, and except in cases of concurrent delay, was the sole cause of such impact, and (2) could not have been avoided by resequencing of the Work or by using other reasonable alternatives.

Contractor may request additional time to respond to the supplemental information requested by the Construction Manager. If a request combined with previous extension requests, equals 20 percent or more of the original Contract time then the Contractor's letter of request must bear consent of Surety. In evaluating requests for time extension, the Construction Manager will consider how well the Contractor used the time from Contract execution up to the point of the delay and the effect the delay had on any completion times included in the Special Provisions. The Construction Manager will evaluate and issue a Written Determination within 21 calendar days of receiving the request or supplemental information.

Working days added to the Contract by time extensions, when time has overrun, shall only apply to days on which liquidated damages or direct engineering have been charged, such as the following:

If Substantial Completion has been granted prior to all the authorized working days being used, then the number of days in the time extension will eliminate an equal number of days on which direct engineering charges have accrued. If the Substantial Completion Date is established after all the authorized working days have been used, then the number of days in the time extension will eliminate an equal number of days on which liquidated damages or direct engineering charges have accrued.

The Construction Manager will not allow a time extension for causes listed above if it resulted from the Contractor's default, collusion, action or inaction, or failure to comply with the Contract.

The Contracting Agency considers the time specified in the Special Provisions as sufficient to do all the Work. For this reason, the Contracting Agency will not grant a time extension for:

1. Failure to obtain all materials and workers unless the failure was the result of exceptional causes.
2. Changes, protests, increased quantities, or changed conditions that do not delay the completion of the Contract or prove to be an invalid or inappropriate time extension request.
3. Delays caused by nonapproval of drawings or plans.
4. Rejection of faulty or inappropriate equipment.

If the Contractor does not agree with the Construction Manager's Written Determination, the Contractor shall pursue the protest in accordance with PART 03 of this Section. By failing to follow the procedures, the Contractor completely waives claims for protested Work.

Any change in the Contract Time covered by a Change Order or based on a request for an equitable adjustment in the Contract Time, shall be limited to the change in the critical path of Contractor's schedule attributable to the change of Work or event(s) giving rise to the request for equitable adjustment. Any Change Order proposal or request for an adjustment in the Contract Time shall demonstrate the impact on the critical path of the schedule. Contractor shall be responsible for showing clearly on the Progress Schedule that the change or event: had a specific impact on the critical path, and except in case of concurrent delay, was the sole cause of such impact; and could not have been avoided by resequencing of the Work or other reasonable alternatives.

Damages For Delay

It is agreed that the work covered by this contract shall be completed in all respects within the specified time from the date of Notice to Proceed. It is further agreed that the Contracting Agency will suffer damage and be put to additional expense if the Contractor shall not have the work completed in all respects and ready for use prior to the completion date stated.

Until such time that actual damages can be accurately computed, the Contractor hereby covenants and agrees to pay to the Contracting Agency the sum of **\$1,000 per day** as liquidated damages for each day required to accomplish substantial completion of the work beyond the period above fixed. Following Substantial Completion, Contractor shall pay the Contracting Agency \$500 per day as liquidated damages for each day required to accomplish Final Completion beyond the specified period. It is hereby agreed that the above amount shall be deducted from payment due the Contractor or deducted from any sums retained for benefit of employees, subcontractors, or suppliers (provided the Contracting Agency's claim shall be subject to claims filed against the retained percent).

In addition to liquidated damages specified above, if the Contractor's actions during the performance of this work results in the Lab spaces in the Lab Admin Building not being functional the County will charge the Contractor **\$8,000 per day** for every day the lab is not in operation.

No damages or additional compensation shall be owed to the Contractor, should the Contractor complete the project, or any part of the project, ahead of schedule, because of his unilateral decision to accelerate all or a portion of the work.

Substantial Completion

The Contractor, upon considering the work to be substantially complete and ready for its intended use, shall so notify the Construction Manager in writing. The notification shall include an itemized list of remaining incomplete work. If the Construction Manager determines that the work is not substantially complete, he will notify the Contractor in writing identifying the reasons for such a determination. If the Construction Manager finds the work substantially complete, he will meet with the Contractor to (1)

prepare a punch list of incomplete items of work; (2) define the division of responsibility between Contracting Agency and Contractor with respect to security, operation, maintenance, heat, utilities, insurance, and warranties; and (3) describe any other issues related to acceptance of the substantially completed work. Upon reaching agreement with the Contractor, the Construction Manager will write to the Contracting Agency, certifying that the work is substantially complete, listing the items of incomplete work, stating the date for completion of incomplete work, defining the division of responsibilities, and setting forth any other terms related to acceptance.

Upon provision of the Contractor's acknowledgment letter, the Contracting Agency shall take possession of the work or portion of the work and put it into its intended service. The date that the work or portion of the work is put into service will become the date of substantial completion. Unless otherwise specified, guarantees and warranties will begin on the date of substantial completion.

After the substantial completion date, the Contracting Agency may exclude the Contractor from the work during such periods when construction activities might interfere with the operation of the facility. The Contracting Agency, however, shall allow the Contractor reasonable access for completion or correction of incomplete punch list items.

Acceptance of the Project

Upon completion of the work, including portions of the work previously accepted as substantially complete, the Contractor shall notify the Construction Manager in writing. Upon receipt of the notification, the Construction Manager will determine if the work conforms to the terms of the contract. If he finds materials, equipment, or workmanship which do not meet the terms of the contract, he shall prepare a punch list of such items and submit it to the Contractor. Following completion of the corrective work by the Contractor, the Construction Manager shall notify the Contracting Agency that the work has been completed in accordance with the contract. Final determination of the acceptability shall be made by the Contracting Agency. Upon acceptance of the project, the Contracting Agency shall immediately file a notice of completion. For portions of the project not previously accepted as substantially complete, the conditions of guarantee shall commence on the date that the Contracting Agency files a notice of completion.

The final application for payment shall be accompanied by all required documentation called for in the contract including complete and legally effective releases or waivers of liens in a form acceptable to Contracting Agency. Subject to prior approval of Contracting Agency, Contractor may submit in lieu of the lien releases and waivers: (1) receipts of releases in full; (2) an affidavit that the releases and receipts cover all labor, services, materials, and equipment for which a lien could be filed and that all payrolls, materials, and equipment bills and other indebtedness connected with the work for which Contracting Agency or Contracting Agency's property might in any way be responsible have been paid or otherwise satisfied; and (3) consent of the surety, if any, to final payment. If any subcontractor or

supplier fails to furnish a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Contracting Agency to indemnify Contracting Agency against any lien.

If, after reviewing the Contractor's final application for payment including all documentation required, the Construction Manager determines that the work is complete, he will recommend that final payment, including all retainages, be made by the Contracting Agency. The final payment will be due and payable by the Contracting Agency within 30 days after any legal notice periods have expired.

Suspension Procedures

The Construction Manager may order suspension of all or any part of the Work if:

1. Unsuitable weather prevents satisfactory and timely performance of the Work; or
2. The Contractor does not comply with the Contract; or
3. It is in the public interest.

When ordered by the Construction Manager to suspend or resume Work, the Contractor shall do so immediately.

If the Work is suspended for reason (1) above, the period of Work stoppage will be counted as unworkable days. But if the Construction Manager believes the Contractor should have completed the suspended Work before the suspension, all or part of the suspension period may be counted as working days. The Construction Manager will set the number of unworkable days (or parts of days) by deciding how long the suspension delayed the entire project.

If the Work is suspended for reason (2) above, the period of Work stoppage will be counted as working days. The lost Work time, however, shall not relieve the Contractor from the Contract responsibility.

If the performance of all or any part of the Work is suspended, delayed, or interrupted for an unreasonable period of time by an act of the Contracting Agency in the administration of the Contract, or by failure to act within the time specified in the Contract (or if no time is specified, within a reasonable time), the Construction Manager will make an adjustment for increases in the cost or time for the performance of the Contract (excluding profit) necessarily caused by the suspension, delay, or interruption. However, no adjustment will be made for suspensions, delays, or interruptions if (1) the performance would have been suspended, delayed, or interrupted by other causes, including the fault or negligence of the Contractor, or (2) an equitable adjustment is provided for or excluded under another provision of the Contract.

If the Contractor believes that the performance of the Work is suspended, delayed, or interrupted for an unreasonable period and such suspension, delay, or interruption is the responsibility of the Contracting Agency, the Contractor shall immediately submit a written notice of protest to the Construction Manager within 14 calendar days of the start of the suspension delay or interruption

requesting an equitable adjustment. No adjustment shall be allowed for costs incurred more than 14 calendar days before the date the Construction Manager receives the Contractor's written notice of protest. The Construction Manager will issue a Written Determination to the Contractor and adjust payment and time in accordance with this section, if warranted. If the Contractor does not agree with the Written Determination, then the Contractor shall pursue protest procedures in PART 03 of this Section. The Contractor shall keep full and complete records of the costs and additional time of such suspension, delay, or interruption and shall permit the Construction Manager to have access to those records and any other records as may be deemed necessary by the Construction Manager to assist in evaluating the protest.

The Construction Manager will determine if an equitable adjustment in cost or time is due as provided in this section. The equitable adjustment for increase in costs, if due, shall be subject to the limitations provided in these provisions, provided that no profit of any kind will be allowed on increases in costs caused by the suspension, delay, or interruption. Request for extensions of time will be evaluated in accordance with these provisions.

The Construction Manager's determination regarding adjustments will be final.

Termination For Default

The Contracting Agency may terminate the Contract for of one or more of the following events:

1. If the Contractor fails to supply sufficient skilled workers or suitable materials or equipment;
2. If the Contractor refuses or fails to prosecute the Work with such diligence as will ensure its Physical Completion within the original Physical Completion time plus extensions of time which may have been granted to the Contractor by change order;
3. If the Contractor is adjudged bankrupt or insolvent, or makes a general assignment for the benefit of creditors, or if the Contractor or a third party files a petition to take advantage of a debtor's act or to reorganize under the bankruptcy or similar laws concerning the Contractor, or if a trustee or receiver is appointed for the Contractor or for any of the Contractor's property on account of the Contractor's insolvency, and the Contractor or its successor in interest does not provide adequate assurance of future performance in accordance with the Contract within 15 calendar days of receipt of a request for assurance from the Contracting Agency;
4. If the Contractor disregards laws, ordinances, rules, codes, regulations, orders or similar requirements of any public entity having jurisdiction.
5. If the Contractor disregards the authority of the Contracting Agency;
6. If the Contractor performs Work which deviates from the Contract, and neglects or refuses to correct rejected Work; or
7. If the Contractor otherwise violates in any material way any provisions or requirements of the Contract.

Once the Contracting Agency determines that sufficient cause exists to terminate the Contract, written notice shall be given to the Contractor and its Surety indicating that the Contractor is in breach of the Contract and that the Contractor is to remedy the breach within 15 calendar days after the notice is sent. In case of an emergency such as potential damage to life or property, the response time to remedy the breach after the notice may be shortened. If the remedy does not take place to the satisfaction of the Contracting Agency, the Construction Manager may, by serving written notice to the Contractor and Surety either:

1. Transfer the performance of the Work from the Contractor to the Surety; or
2. Terminate the Contract and at the Contracting Agency's option prosecute it to completion by contract or otherwise. Extra costs or damages to the Contracting Agency shall be deducted from money due or coming due to the Contractor under the Contract.

If the Construction Manager elects to pursue one remedy, it will not bar the Construction Manager from pursuing other remedies on the same or subsequent breaches.

Upon receipt of a notice that the Work is being transferred to the Surety, the Surety shall enter upon the premises and take possession of all materials, tools, and appliances for the purpose of completing the Work included under the Contract and employ by contract or otherwise any person or persons satisfactory to the Construction Manager to finish the Work and provide the materials without termination of the Contract. Such employment shall not relieve the Surety of its obligations under the Contract and the bond. If there is a transfer to the Surety, payments on estimates covering Work after the transfer shall be made to the extent permitted under law to the Surety or its agent without any right of the Contractor to make any claim.

If the Construction Manager terminates the Contract or provides such sufficiency of labor or materials as required to complete the Work, the Contractor shall not be entitled to receive any further payments on the Contract until all the Work contemplated by the Contract has been fully performed. The Contractor shall bear any extra expenses incurred by the Contracting Agency in completing the Work, including all increased costs for completing the Work, and all damages sustained, or which may be sustained, by the Contracting Agency by reason of such refusal, neglect, failure, or discontinuance of Work by the Contractor. If liquidated damages are provided in the Contract, the Contractor shall be liable for such liquidated damages until such reasonable time as may be required for Physical Completion of the Work. After all the Work contemplated by the Contract has been completed, the Construction Manager will calculate the total expenses and damages for the completed Work. If the total expenses and damages are less than any unpaid balance due the Contractor, the excess will be paid by the Contracting Agency to the Contractor. If the total expenses and damages exceed the unpaid balance, the Contractor and the Surety shall be jointly and severally liable to the Contracting Agency and shall pay the difference to the Contracting Agency on demand.

In exercising the Contracting Agency's right to prosecute the Physical Completion of the Work, the Contracting Agency shall have the right to exercise its sole discretion as to the manner, method, and reasonableness of the costs of completing the Work.

If the Contracting Agency takes Bids for remedial Work or Physical Completion of the project, the Contractor shall not be eligible for the Award of such Contracts. In the event the Contract is terminated, the termination shall not affect any rights of the Contracting Agency against the Contractor. The rights and remedies of the Contracting Agency under the Termination Clause are in addition to any other rights and remedies provided by law or under this Contract. Any retention or payment of monies to the Contractor by the Contracting Agency will not release the Contractor from liability.

If a notice of termination for default has been issued and it is later determined for any reason that the Contractor was not in default, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to Termination for Public Convenience. This shall include termination for default because of failure to prosecute the Work, and the delay was found to be excusable.

Termination For Public Convenience

The Construction Manager may terminate the Contract in whole, or from time to time in part, whenever:

1. The Contractor is prevented from proceeding with the Work as a direct result of an Executive Order of the President with respect to the prosecution of war or in the interest of national defense; or an Executive Order of the President or Governor of the State with respect to the preservation of energy resources;
2. The Contractor is prevented from proceeding with the Work by reason of a preliminary, special, or permanent restraining order of a court of competent jurisdiction where the issuance of such restraining order is primarily caused by acts or omissions of persons or agencies other than the Contractor; or
3. The Construction Manager determines that such termination is in the best interests of the Contracting Agency.

After receipt of Termination for Public Convenience, the Contractor shall submit to the Contracting Agency a request for costs associated with the termination. The request shall be prepared in accordance with the claim procedures. The request shall be submitted promptly but in no event later than 90 calendar days from the effective date of termination.

The Contractor agrees to make all records available to the extent deemed necessary by the Construction Manager to verify the costs in the Contractor's payment request.

Whenever the Contract is terminated in accordance with the above, payment will be made in accordance with the actual Work performed.

If the Contracting Agency and the Contractor cannot agree as to the proper amount of payment, then the matter will be resolved by claims resolution except that, if the termination occurs because of the issuance of a

restraining order, the matter will be resolved through mandatory and binding arbitration, regardless of the amount of the claim.

Termination of a Contract shall not relieve the Contractor of any responsibilities under the Contract for Work performed. Nor shall termination of the Contract relieve the Surety or Sureties of obligations under the Contract Bond or retainage bond for Work performed.

Assignment

The Contractor shall not assign all or any part of the Work unless the Construction Manager approves in writing. The Construction Manager will not approve any proposed assignment that would relieve the original Contractor or Surety of responsibility under the Contract. Money due (or that will become due) to the Contractor may be assigned. If given written notice, the Contracting Agency will honor such an assignment to the extent the law permits. But the assignment shall be subject to all setoffs, withholdings, and deductions required by law and the Contract.

PART 09 PAYMENT

The unit or lump sum Contract Prices shall constitute full payment for furnishing all labor, equipment, materials, permits and agreements, overhead and profit, and performing all operations required to complete the Work as defined in the Contract Documents. Notwithstanding the omission or mention of any incidental Work, the Contract Price and payment shall also constitute full compensation for all Work incidental to completion of item, unless such Work is otherwise specifically mentioned for separate payment under another Bid Item. Payment shall only be made for those items included in the Proposal and all Work required by the Contract shall be included in those Bid Items.

All measurements and computations shall be made by the Engineer or the Contracting Agency's Representative. Contractor may perform quantity surveys for comparison at the Contractor's sole expense. If there is a discrepancy where the measured quantity cannot be agreed upon, the Engineer or Contracting Agency's Representative measurements shall be used.

Scope of Payment

Payments will be made in accordance with Section 01 20 00.

The basis of payment will be the actual quantities of Work performed according to the Contract and as specified for payment.

The Contractor shall submit a breakdown of the cost of lump sum bid items at the Preconstruction Conference, to enable the Construction Manager to determine the Work performed monthly. Absent a lump sum breakdown, the Construction Manager will decide based on information available. The Construction Manager's determination of the cost of work shall be final.

Progress payments for completed work and material on hand will be based upon progress estimates prepared by the Construction Manager. A progress estimate cutoff date will be established at the preconstruction conference.

The initial progress estimate will be made not later than 30 days after the Contractor commences the work, and successive progress estimates will be made every month thereafter until the Completion Date. Progress estimates made during progress of the work are tentative and made only for the purpose of determining progress payments. The progress estimates are subject to change at any time prior to the calculation of the final payment.

Failure to perform obligations of the Contract may be decreed by the Contracting Agency to be adequate reason for withholding payments until compliance is achieved.

Upon completion of all Work and after final inspection (Section 1-05.11), the amount due the Contractor under the Contract will be paid based upon the final estimate made by the Engineer and presentation of a Final Contract Voucher Certification to be signed by the Contractor. The Contractor's signature on such voucher shall be deemed a release of all claims of the Contractor unless a Certified Claim is filed in accordance with the requirements of Section 1-09.11 and is expressly excepted from the Contractor's certification on the Final Contract Voucher Certification. The date the Secretary signs the Final Contract Voucher Certification constitutes the final acceptance date (Section 1-05.12).

If the Contractor fails, refuses, or is unable to sign and return the Final Contract Voucher Certification or other documentation required for completion and final acceptance of the Contract, the Contracting Agency reserves the right to establish a Completion Date (for the purpose of meeting the requirements of RCW 60.28) and unilaterally accept the Contract. Unilateral final acceptance will occur only after the Contractor has been provided the opportunity, by written request from the Engineer, to voluntarily submit such documents. If voluntary compliance is not achieved, formal notification of the impending establishment of a Completion Date and unilateral final acceptance will be provided by email with delivery confirmation from the Secretary to the Contractor, which will provide 30-calendar days for the Contractor to submit the necessary documents. The 30-calendar day period will begin on the date the email with delivery confirmation is received by the Contractor. The date the Secretary unilaterally signs the Final Contract Voucher Certification shall constitute the Completion Date and the final acceptance date. The reservation by the Contracting Agency to unilaterally accept the Contract will apply to Contracts that are Physically Completed, or for Contracts that are terminated. Unilateral final acceptance of the Contract by the Contracting Agency does not in any way relieve the Contractor of their responsibility to comply with all Federal, State, tribal, or local laws, ordinances, and regulations that affect the Work under the Contract.

Payment to the Contractor of partial estimates, final estimates, and retained percentages shall be subject to controlling laws.

The payment provided for in the Contract shall be full payment to the Contractor for:

1. Furnishing all materials and performing all Work under the Contract (including changes in the work, materials, or Plans) in a complete and acceptable manner;
2. All risk, loss, damage, or expense of whatever character arising out of the nature or prosecution of the work; and
3. All expense incurred resulting from a suspension or discontinuance of the Work as specified under the Contract.

The payment of an estimate or retained percentage shall not relieve the Contractor of the obligation to correct defective Work or materials.

If the "Payment" clause in the Specifications, for an item included in the Proposal, covers and considers all Work and material essential to that item, then the Work or materials will not be measured or paid for under any other item that may appear elsewhere in the Proposal or Specifications

Equitable Adjustment

If the cost of Contractor's performance is changed due to the fault or negligence of Contracting Agency, or anyone for whose acts the Contracting Agency is responsible, Contractor shall be entitled to make a request for an equitable adjustment in the Contract Sum in accordance with the following procedure. No change in the Contract sum shall be allowed to the extent Contractor's changed cost of performance is due to the fault or negligence of Contractor, or anyone for whose acts Contractor is responsible; the change is concurrently caused by Contractor and Contracting Agency; or the change is caused by an act of Force Majeure.

A request for an equitable adjustment in the Contract Sum shall be based on written notice delivered to the Construction Manager within 7 days of the occurrence of the event giving rise to the request. For purposes of this part, "occurrence" means when Contractor knew, or in its diligent prosecution of the Work should have known, of the event giving rise to the request. If Contractor believes it is entitled to an adjustment in the Contract Sum, Contractor shall immediately notify the Construction Manager and begin to keep and maintain complete, accurate, and specific daily records. Contractor shall give Construction Manager access to any such records and, if requested shall promptly furnish copies of such records to Construction Manager.

Contractor shall not be entitled to any adjustment in the Contract Sum for any occurrence of events or costs that occurred more than 7 days before Contractor's written notice to the Construction Manager. The written notice shall set forth, at a minimum, a description of the event giving rise to the request for an equitable adjustment in the Contract Sum; the nature of the impacts to Contractor and its Subcontractors, if any; and to the extent possible the amount of the adjustment in Contract Sum requested. Failure to properly give such written notice shall, to the extent Contracting Agency's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

Within 30 days of the occurrence of the event giving rise to the request, unless Construction Manager agrees in writing to allow an additional period to ascertain more accurate data, Contractor shall supplement written notice provided in accordance with subparagraph a. above with additional supporting data. Such additional data shall include, at a minimum: the amount of compensation requested, itemized in accordance with the procedure set forth herein; specific facts, circumstances, and analysis that confirms not only that Contractor suffered the damages claimed, but that the damages claimed were actually a result of the act, event, or condition complained of and that the Contract Documents provide

entitlement to an equitable adjustment to Contractor for such act, event, or condition; and documentation sufficiently detailed to permit an informed analysis of the request by Contracting Agency. When the request for compensation relates to a delay, or other change in Contract Time, Contractor shall demonstrate the impact on the critical path. Failure to provide such additional information and documentation within the time allowed or within the format required shall, to the extent Contracting Agency's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

Pending final resolution of any request made in accordance with this paragraph, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Work.

Any requests by Contractor for an equitable adjustment in the Contract Sum and in the Contract Time that arise out of the same event(s) shall be submitted together.

Mobilization and Demobilization

Mobilization consists of preconstruction expenses and the costs of preparatory Work and operations performed by the Contractor typically occurring before 10 percent of the total original Contract amount is earned from other Contract items. Items which are not to be included in the item of Mobilization include but are not limited to: 1. Portions of the Work covered by the specific Contract item or incidental Work which is to be included in a Contract item or items. 2. Profit, interest on borrowed money, overhead, or management costs. 3. Costs incurred for mobilizing equipment to perform force account Work.

"Mobilization and Demobilization" shall include but not be limited to the following items:

1. Movement of Contractor's personnel, equipment, supplies, and incidentals to the project site;
2. The establishment of onsite trailer, including procurement of all utilities to serve the offices such as power, telephone, fax, high speed internet, etc.;
3. Securing suitable storage area(s), staging area(s), parking area(s) and other facilities necessary for work on the project;
4. Providing sanitary facilities for Contractor and Contracting Agency personnel;
5. All other pre-construction expenses and costs for preparatory work and operations performed by the Contractor; and
6. All demobilization costs, including removal of equipment, excess materials, trailer, and general cleanup.

Retainage.

Pursuant to RCW 60.28, a sum of 5 percent of the monies earned by the Contractor will be retained from progress estimates. Such retainage shall be used as a trust fund for the protection and payment (1) to the Contracting Agency with respect to taxes imposed pursuant to Title 82 RCW, and (2) the claims of any person arising under the Contract.

Monies retained under the provisions of RCW 60.28 shall, at the option of the Contractor, be:

1. Retained in a fund by the Contracting Agency; or

2. Deposited by the Contracting Agency in an escrow (interest-bearing) account in a bank, mutual saving bank, or savings and loan association (interest on monies so retained shall be paid to the Contractor). Deposits are to be in the name of the Contracting Agency and are not to be allowed to be withdrawn without the Contracting Agency's written authorization. The Contracting Agency will issue a check representing the sum of the monies reserved, payable to the bank or trust company. Such check shall be converted into bonds and securities chosen by the Contractor as the interest accrues.

At the time the Contract is executed the Contractor shall designate the option desired. The Contractor in choosing option (2) agrees to assume full responsibility to pay all costs that may accrue from escrow services, brokerage charges or both, and further agrees to assume all risks in connection with the investment of the retained percentages in securities. The Contracting Agency may also, at its option, accept a bond in lieu of retainage.

Release of the retainage will be made 60 days following the Completion Date (pursuant to RCW 39.12, and RCW 60.28) provided the following conditions are met:

1. On Contracts totaling more than \$35,000, a release has been obtained from the Washington State Department of Revenue.

2. Affidavits of Wages Paid for the Contractor and all subcontractors are on file with the Contracting Agency (RCW 39.12.040).

3. A certificate of Payment of Contributions Penalties and Interest on Public Works Contract is received from the Washington State Employment Security Department.

4. Washington State Department of Labor and Industries (in accordance with Section 1-07.10) shows the Contractor is current with payments of industrial insurance and medical aid premiums.

5. All claims, as provided by law, filed against the retainage have been resolved. In the event claims are filed and provided the conditions of 1, 2, 3, and 4 are met, the Contractor will be paid such retained percentage less an amount sufficient to pay any such claims together with a sum determined by the Contracting Agency sufficient to pay the cost of foreclosing on claims and to cover attorney's fees.

Final Payment

By accepting final payment, the Contractor shall be deemed thereby to have released Kitsap County from all claims of and all liability to the Contractor for things done or furnished in connection with the work and for every act and neglect of Kitsap County and others relating to or arising out of the work, other than timely written claims identified in detail and stated amounts that were submitted prior to final payment and in strict compliance with the requirements of this Contract. Payment by Kitsap County shall not release the Contractor or its surety from any obligation under the Contract or under the Performance and Payment Bond.

Retention Of Records and Audit

The Contractor's wage, payroll, and cost records on this Contract shall be open to inspection or audit by representatives of the Contracting Agency during the life of the Contract and for a period of not less than 3 years after the date of final acceptance of the Contract. The Contractor shall retain these records for that period. The Contractor shall also guarantee that the wage, payroll, and cost records of all subcontractors shall be retained and open to similar inspection or audit for the same period. The audit may be conducted by employees of the Contracting Agency or by an auditor under contract with the Contracting Agency. The Contractor and subcontractors shall provide adequate facilities, acceptable to the Engineer, for the audit during normal business hours. The Contractor and subcontractors shall make a good faith effort to cooperate with the auditors. If an audit is to be commenced more than 60 calendar days after the final acceptance date of the Contract, the Contractor will be given 20 calendar days' notice of the time when the audit is to begin. If any litigation, claim, or audit arising out of, in connection with, or related to this Contract is initiated, the wage, payroll, and cost records shall be retained until such litigation, claim, or audit involving the records is completed.

****END OF SECTION****

SECTION 01 10 00 – SUMMARY**PART 1 – GENERAL****1.1 PROJECT**

- A. Project Name: Central Kitsap Treatment Plant HVAC Upgrades.
- B. Owner's Name: Kitsap County Sewer Utility.
- C. The Project consists of the installation of an HVAC replacement in three buildings at the Central Kitsap Treatment Plant, located at:

12351 Brownsville Highway NE
Poulsbo, WA 98370.

The three buildings are the Administration and Laboratory Building, the Process Building, and the Headworks Building.

1.2 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in the Public Works Agreement Form.

1.3 WORK BY OWNER

- A. Items noted NIC (Not in Contract) will be removed from the area of work prior to the contractor mobilization (laboratory rooms and electrical room). Some items include:
 - 1. Movable cabinets.
 - 2. Furnishings.
 - 3. Small equipment.
 - 4. Rugs.
 - 5. Miscellaneous equipment, and stored materials.

1.4 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner 's operations.
- C. Schedule the Work to accommodate Owner occupancy. Hours of construction are: 7:00 am to 4:00 pm during business days, unless otherwise scheduled with the Inspector or Construction Manager. The Construction Manager will arrange for additional space at CKTP upon request.

1.5 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
 - 2. Temporary building, equipment storage, and/or vehicle parking is available north of the Laboratory/Admin Bldg (maintain utility road access). The Construction Manager will arrange for additional space at CKTP upon request.

- B. TEMPORARY UTILITY SERVICES
 - 1. On-premises electrical power is available for contractor use; all connections and restoration are the responsibility of the contractor.
 - 2. On-premises potable water is available for contractor use; all connections and restoration are the responsibility of the contractor.
 - 3. Bathroom facilities in the Laboratory/Admin Bldg are NOT available for contractor use.
- C. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Work by Others.
 - 3. Work by Owner.
- D. 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 a permit.
- E. Existing building spaces may not be used for storage.
- F. Utility Outages and Shutdown:
 - 1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 1 week notice to Owner and authorities having jurisdiction.
 - 2. No shutdown of utility services between 7:00 AM and 4:00 PM each work day unless otherwise coordinated with and authorized by Construction Manager
 - 3. Prevent disruption of utility services to other facilities. Should an accidental disruption occur, immediately coordinate with the Inspector or Construction Manager, and provide an estimated time of return of utility.

1.6 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner.

1.7 SPECIFICATION SECTIONS APPLICABLE TO EVERY CONTRACT

- A. Unless otherwise noted, provisions of the sections listed below apply to every contract. Specific items of work listed under individual contract descriptions constitute exceptions.
- B. Section 01 20 00 – Price and Payment Procedures.
- C. Section 01 30 00 – Administrative Requirements.
- D. Section 01 40 00 – Quality Requirements.
- E. Section 01 60 00 – Product Requirements.
- F. Section 01 70 00 – Execution and Closeout Requirements.

SECTION 01 10 00

SUMMARY OF WORK

G. Section 01 78 00 – Closeout Submittals.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 10 00

SECTION 01 20 00 – PRICE AND PAYMENT PROCEDURES**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Change procedures.

1.2 SCHEDULE OF VALUES

- A. Use Schedule of Values Form AIA G703
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Owner for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in electronic copy within 15 days after date of Owner- Contractor Agreement.
- E. The Contractor warrants that such values are accurate representations of the value of each activity, on which Kitsap County may rely.

1.3 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Submit electronically by the 5th day of each month covering acceptable work performed and materials received during the previous month.
- B. Use Form AIA G702, Form AIA G703 and AIA G707.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Construction Manager for approval.
- D. Forms filled out by hand will not be accepted.
- E. If requested by the Construction Manager, the Contractor shall provide such additional data as may be reasonably required to support the payment for materials and labor, including payments to subcontractors and suppliers.
- F. To receive partial payment for materials delivered on-site but not yet incorporated in the work, Contractor shall properly store and protect materials, the Contractor shall submit a list with certified invoices of such materials to the Construction Manager for approval with the Contractor's partial payment estimate. Proper storage and protection of materials shall be provided. Partial payment for materials delivered but not yet incorporated in the work will not exceed 75 percent of the purchase value for such materials.
- G. Execute certification by signature of authorized officer.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one electronic copies of each Application for Payment.
- J. Submit Monthly red-line drawings for review by Construction Manager, with each application for payment.

1.4 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, the Construction Manager or Inspector will issue instructions directly to the Contractor.
- C. For other required changes, the Construction Manager will issue a written directive instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Construction Manager may request a written Change Order proposal from Contractor through the Construction Manager. Contractor shall submit a Change Order proposal within 14 days of the request from Contracting Agency/Construction Manager, or within such other period as mutually agreed. Contractor's Change Order proposal shall be full compensation for implementing the proposed change in the Work and for any expense or inconvenience, disruption of schedule, or loss of efficiency in the Work.

Construction Manager may accept or reject the proposal, request further documentation, or negotiate acceptable terms with Contractor. Pending agreement on the terms of the Change Order, Contracting Agency/Construction Manager may direct Contractor to proceed immediately with the Change Order Work. Contractor shall not proceed with any change in the Work until it has obtained Contracting Agency's approval. All Work done pursuant to any Contracting Agency- or Construction Manager-directed change in the Work shall be executed in accordance with the Contract Documents.

If Contracting Agency/Construction Manager and Contractor reach agreement on the terms of any change in the Work, including any adjustments in the Contract Sum or Contract Time, such agreement shall be incorporated in a change Order. The Change Order shall constitute full payment and final settlement of all claims for time and for direct, indirect, and consequential costs, including costs of delays, inconvenience, disruption of schedule, or loss of efficiency or productivity, related to any Work either covered or affected by the Change Order, or related to the events giving rise to the request for equitable adjustment.

If Contracting Agency/Construction Manager and Contractor are unable to reach agreement on the terms of any change in the Work, including any adjustment in the Contract Sum or Contract Time, Contractor may at any time, in writing, request a final offer from Contracting Agency/Construction Manager.

Contracting Agency/Construction Manager shall provide Contractor with its written response within 30 days of Contractor's request. Contracting Agency/Construction Manager may also provide Contractor with a final offer at any time. If Contractor rejects Contracting Agency/Construction Manager's final offer, or the parties are otherwise unable to reach agreement, Contractor's only remedy shall be to file a Claim as provided in Section 00 70 00.

- E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

1. For change requested by Owner for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Owner.
- F. Substantiation of Costs: Provide full information required for evaluation.
1. Provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times the work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- G. Execution of Change Orders: Construction Manager will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- J. Promptly enter changes in Project Record Documents.

1.5 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 1. All closeout procedures specified in Section 01 70 00.
- C. Final payment to the Contractor following acceptance of all work, release of claims brought to the attention of Kitsap County,
- D. Final payment shall include the entire sum found to be due hereunder after deducting therefrom such amounts as the terms of this Contract permit. Prior estimates and payments, including those relating to extra work or work omitted, shall be subject to correction by the final payment.
- E. Final payment will be made only for materials incorporated in the work; and all materials remaining for which progress payments have been made shall revert to the Contractor,

SECTION 01 20 00

PRICE AND PAYMENT

unless otherwise agreed, and partial payments made for these items shall be deducted from the final payment for the work.

END OF SECTION 01 20 00

SECTION 01 30 00 – ADMINISTRATIVE REQUIREMENTS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Onsite construction drawing set shall be redlined for changes and modifications. These drawings shall be provided to the Owner at the end of the contract for As- Constructed set of drawings.
- H. Submittals for review, information, and project closeout.
- I. Number of copies of submittals.
- J. Requests for Information (RFI) procedures.
- K. Submittal procedures.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 – Product Requirements: General product requirements.
- B. Section 01 70 00 – Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 01 78 00 – Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.3 REFERENCE STANDARDS

- A. AIA G716 – Request for Information.

1.4 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 70 00 – Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
 - 1. Make the following types of submittals to Construction Manager:
 - 2. Requests for Information (RFI).
 - 3. Requests for substitution.
 - 4. Shop drawings, product data, and samples.
 - 5. Test and inspection reports.
 - 6. Design data.
 - 7. Manufacturer’s instructions and field reports.

8. Applications for payment and change order requests.
9. Progress schedules.
10. Coordination drawings.
11. Correction Punch List and Final Correction Punch List for Substantial Completion.
12. Closeout submittals.

PART 2 – PRODUCTS – NOT USED**PART 3 – EXECUTION****3.1 ELECTRONIC DOCUMENT SUBMITTAL SERVICE**

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF/Revu, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via the County's SYNCHRO (by Bentley) submittal service that receives, logs, and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents, applications for payment, Contractor's correction punch list, and any other document any participant wishes to make part of the project record.
 2. Contractor and Construction Manager are required to use this service.
 3. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat or Bluebeam PDF Revu).
 4. Document requirements do not apply to samples or color selection charts.
- B. Cost: The cost of the service is to be paid by the County.
- C. Training: The County will provide informal training for participants as needed.

3.2 PRECONSTRUCTION WORK PHASE

- A. This Section specifies planning and work included within the Preconstruction Work Phase that takes place during the period after the Limited Notice to Proceed and prior to the start of the work authorized by the Notice to Proceed with Construction. The planning effort includes identifying and organizing the Contractor's work team, planning the construction activities with the Construction Manager, establishing the initial survey control, preparing and delivering priority submittals for equipment, and other activities related to planning activities identified herein.
 1. To accomplish the preconstruction activities, the Contractor shall provide staff to meet on the project site as needed and shall establish and maintain an office in the Puget Sound region to accomplish the work. Satisfactory completion of the Preconstruction Work Phase activities will be a prerequisite to the Notice to Proceed with Construction for the Construction Work Phase.
 2. Submittal information shall be provided in sufficient detail to verify compliance with the specifications during the Preconstruction Work Phase and shall be provided prior to Notice to Proceed with Construction for the Construction Work Phase. The Contractor shall make arrange with subcontractors and suppliers for the preparation and submittal of required documentation.

B. Preconstruction Activities

The following is a list of the activities to be included in the Preconstruction Work Phase. Each of the activities and required work products are defined either within this specification or in specification sections in the General Conditions.

1. Contractor's Management and Work Plan
2. Project Safety and Accident Prevention Program
3. Health and Safety Plan (CHSP)
4. Onsite Investigations / Preconstruction Photographs
5. Submittals
 1. Submittal Plan
 2. Priority or Long Lead Time Material Submittals
6. Spill Prevention, Control, and Countermeasures Plan
7. Contractor Furnished Permits
8. Schedules
 - a. Schedule of Values
 - b. Construction Schedule

C. Contractor's Management and Work Plan

Contractor shall prepare and submit a plan describing in detail the approach and methods for prosecuting the work in accordance with the contract. The Management Plan shall include the following:

1. An organizational chart describing:
 - a. The hierarchy and relationship of the Contractor's project staff;
 - b. The hierarchy of subcontractors and suppliers including the trade(s) or portion(s) for which each is responsible; and
 - c. A resume for the proposed Project Manager and/or site superintendent.
2. An address and phone directory of the Contractor, Subcontractor, and priority equipment suppliers.
3. A narrative describing how the Contractor intends to staff, equip, and supply the job by trade to meet the contract work sequence and schedule constraints.
4. Protocols to protect laboratory staff and operations during construction.

D. Health and Safety Plan (HSP)

The HSP shall include how the Contractor will ensure everyone on the site has been trained on the HSP requirements. This includes subcontractors, suppliers, and anyone on the project site.

E. Onsite Investigations and Preconstruction Photos

The Contractor shall perform on-site investigations in support of technical submittal preparation. Activities include but may not be limited to the following:

1. Perform utility excavations to support collection of the as-built location of existing utilities that may impact or be impacted by the Work under this Contract.
2. Take preconstruction photos documenting existing conditions.

F. Submittals

1. Prepare and submit a complete schedule of work-related submittals required by the Specifications within ten (10) calendar days of the Preconstruction Meeting.

G. Spill Prevention, Control and Countermeasures Plan.

1. Prepare and submit an SPCC using the template provided at the Washington State Department of Transportation (WSDOT) Stormwater and Water Quality webpage under the "Tools, templates, and links" tab.

H. Contractor Furnished Permits

The Contractor shall apply for and obtain the Contractor Furnished Permits per Section 00 70 00 PART 04, during the Preconstruction Work Phase. Apply to the Kitsap County Department of Community Development (DCD) for a commercial mechanical permit and a building permit, if applicable.

Electrical permit(s) are required and may be obtained through the WA. State Dept. of Labor and Industry.

I. Schedules

The Contractor shall prepare and submit the following schedule information:

1. Schedule of Values for the lump sum Bid items included in the Bid Proposal.
2. Contractor's Construction Schedule:
 - a. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the entire project, with a general outline for remainder of work. Prepare preliminary schedule in the form of a horizontal bar chart.
 - b. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review. The schedule shall be a Type B Progress Schedule depicting the entire project utilizing the critical path method (CPM). Within 10 days of review, submit complete schedule.
 - c. Each week during construction, prepare and submit a two-week look-ahead schedule showing work the Contractor anticipates pursuing and identify work activities accomplished the previous week. The two-week look ahead schedule will be reviewed at the weekly construction progress meeting.

3.3 PRECONSTRUCTION CONFERENCE

- A. Schedule meeting with County Construction Manager within 15 days of Limited Notice to Proceed
- B. County Construction Manager will provide agenda which will include:
 1. Distribution of Contract Documents if not already completed prior to this meeting.
 2. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 3. Designation of personnel representing the parties to Contract and Construction Manager.
 4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 5. Scheduling.

3.4 PROGRESS MEETINGS

- A. The County will schedule and administer weekly (or other periodicity mutually agreed upon) throughout progress of the work. The meetings will be on-site, attendance by superintendent is mandatory.
- B. Agenda:
 1. Review minutes of previous meetings.
 2. Review work progress, including two-week look-ahead schedule.
 3. Field observations, problems, and decisions.
 4. Status of submittal and RFI submission and review.
 5. Environmental issues, including site issues.
 6. Maintenance of quality and work standards.
 7. Safety
 8. Other business relating to work.

3.5 REQUESTS FOR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare in a format and with content acceptable to Owner.
 3. Submit via the County's SYNCHRO system .
 4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- C. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 2. Field dimensions and/or description of conditions which have engendered the request.
 3. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- D. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
1. Review Time: Construction Manager will respond and return RFIs to Contractor within seven calendar days of receipt. Response period may be shortened or lengthened for specific items, subject to mutual agreement.
- E. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

3.6 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:

1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Construction Manager for review for the limited purpose of checking for compliance with Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute as applicable

3.7 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Construction Manager's knowledge as contract administrator or for Owner.

3.8 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 – Closeout Submittals:
1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.9 SUBMITTAL PROCEDURES

- A. General Requirements:
1. Use a single transmittal for related items.
 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.

4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 6. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days.
 - b. For sequential reviews involving Construction Manager's consultants, Owner, or another affected party, allow an additional 7 days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Construction Manager's approval, allow an additional 30 days.
 7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 8. Provide space for Contractor and Construction Manager review stamps.
 9. When revised for resubmission, identify all changes made since previous submission.
 10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 12. Submittals not requested will not be recognized or processed.
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Do not submit (Material) Safety Data Sheets for materials or products.

3.10 SUBMITTAL REVIEW

- A. Submittals for Review: Construction Manager will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Construction Manager will acknowledge receipt and review. See below for actions to be taken.
- C. Construction Manager's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Construction Manager's and consultants' actions on items submitted for review:
 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.

- b. “Approved as Noted, Resubmission not required”, or language with same legal meaning.
 - 1) At Contractor’s option, submit corrected item, with review notations acknowledged and incorporated.
 - c. “Approved as Noted, Resubmit for Record”, or language with same legal meaning.
 - 2. Not Authorizing fabrication, delivery, and installation:
- E. Construction Manager’s and consultants’ actions on items submitted for information:
- 1. Items for which no action was taken:
 - a. “Received” – to notify the Contractor that the submittal has been received for record only.
 - 2. Items for which action was taken:
 - a. “Reviewed” – no further action is required from Contractor.

END OF SECTION 01 30 00

SECTION 01 40 00 – QUALITY REQUIREMENTS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Control of installation.
- B. Defect Assessment.

1.2 DEFINITIONS

- A. Special Inspection: Inspection of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards.

1.3 QUALITY ASSURANCE

1.4 INSPECTION AND TESTING

- A. The Construction Manager may throughout the duration of construction, inspect construction and test materials to assure Contractor conformance with these specifications. This testing will be in addition to that required of the Contractor in this and other specification sections.

PART 2 – EXECUTION

2.1 CONTROL OF INSTALLATION

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

2.2 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.

PART 3 – EXECUTION (NOT USED)**END OF SECTION 01 40 00**

SECTION 01 60 00 – PRODUCT REQUIREMENTS PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage, and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 RELATED REQUIREMENTS

- A. Section 01 10 00 – Summary: Identification of Owner-supplied products.
- B. Section 01 25 00 – Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 74 19 – Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging, and substitutions.

1.3 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 – PRODUCTS

2.1 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 - 1. Made using or containing CFCs or HCFCs.
 - 2. Containing lead, cadmium, or asbestos.

2.2 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.3 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 – EXECUTION**3.1 SUBSTITUTION LIMITATIONS**

- A. See Section 00 70 00, PART 03 CONTROL OF WORK– Substitution Procedures.

3.2 OWNER-SUPPLIED PRODUCTS

- A. See Section 01 10 00 – Summary for identification of Owner-supplied products.
- B. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- C. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

3.3 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on the outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.4 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to the product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- H. Prevent contact with material that may cause corrosion, discoloration, or staining.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 60 00

SECTION 01 70 00 – EXECUTION AND CLOSEOUT REQUIREMENTS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Cutting and patching.
- D. Cleaning and protection.
- E. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- F. General requirements for maintenance service.

1.2 RELATED REQUIREMENTS

- A. Section 01 10 00 – Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 – Administrative Requirements: Submittals procedures.
- C. Section 01 40 00 – Quality Requirements: Testing and inspection procedures.
- D. Section 07 84 00 – Firestopping.

1.3 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight-exposed elements.
 - 5. Work of Owner or separate Contractor.

1.4 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent airborne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
 - 3. Indoors: Limit conduct of especially noisy interior work, coordinate with Owner for onsite activities to minimize impeding Owner's operations/meetings and Owner's clientele onsite activities (such as mediation class hours or holistic basket weaving).

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EXECUTION AND CLOSEOUT REQUIREMENTS

- B. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- C. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulation

1.5 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and cleanup of work of separate sections.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 – PRODUCTS

2.1 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 00 70 00 – Substitutions.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis-fabrication.

- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.4 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Construction Manager before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
 - 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- C. Services (Including but not limited to HVAC, Plumbing, Electrical): Remove, relocate, and extend existing systems to accommodate new construction.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- D. Protect structure, furnishings, finishes, and equipment not indicated or scheduled to be removed.
- E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Construction Manager.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of offsite; do not burn or bury.

- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

3.5 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore it to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools are not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire-rated walls, partitions, ceiling, or floor construction, completely seal voids with fire-rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- J. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.6 PROGRESS CLEANING

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

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- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.7 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.8 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.9 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains, and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.10 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.

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- B. Accompany Inspector on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Construction Manager when work is considered ready for Construction Manager's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Construction Manager's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Construction Manager's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Construction Manager.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Construction Manager when work is considered finally complete and ready for Construction Manager's Substantial Completion final inspection.
- H. Complete items of work determined by Construction Manager listed in executed Certificate of Substantial Completion.

3.11 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 01 70 00

SECTION 01 78 00 – CLOSEOUT SUBMITTALS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.2 RELATED REQUIREMENTS

- A. Section 01 30 00 – Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 70 00 – Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.3 SUBMITTALS

- A. Project Record Documents: Submit documents to Construction Manager with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit electronic copy of preliminary draft or proposed formats and outlines of contents before start of Work. Construction Manager will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Construction Manager comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION**3.1 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.
- G. At completion of project, submit all markups to drawings and specifications in electronic pdf files using Adobe Acrobat or Revu Bluebeam software.

3.2 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

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CLOSEOUT SUBMITTALS

- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.3 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for reordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.4 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with Construction Managing data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color-coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - 1. Include HVAC outdoor and exhaust air damper calibration strategy.
 - a. Include provisions which ensure that full closure of dampers can be achieved.
 - 2. Include Carbon Dioxide Monitoring Protocol.

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3. Include Carbon Monoxide Monitoring Protocol.
4. Include Frost Mitigation Strategy for ventilation heat-recovery system.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.5 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-½ by 11 inch three D size ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Construction Manager, Consultants, Contractor, and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20-pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.
2. Table of Contents, of all volumes, and of this volume.
3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.

3.6 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.
- F. Manual: Bind in three commercial quality 8½ by 11 inch D-size ring binders with durable plastic covers, or provide PDF copy, bookmarked, if requested by Owner. Verify Owner's preferences before sending copies.
- G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION 01 78 00

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS**PART 1 – GENERAL****1.1 COMMISSIONING AGENCY**

- A. The Commissioning Agency (CA) shall be provided by the General Contractor for this project. The CA has overall responsibility for planning and coordinating the commissioning process. However, commissioning involves all parties to the design and construction process, including the Contractor.

1.2 CONTRACTOR RESPONSIBILITY

- A. This Section of the specifications defines the contractor's responsibilities with respect to the commissioning process. Each contractor and subcontractor shall review this Section, and shall include in their bids for carrying out the work described, as it applies to each Division and Section of these specifications, individually and collectively.

1.3 DESCRIPTION OF WORK

- A. The purpose of the commissioning process is to provide the owner/operator of the facility with assurance that the mechanical systems have been installed according to the contract documents, and operate within the performance guidelines set out in the design intent documents (D.I.D.) and these specifications. The CA will provide the Owner with an unbiased, objective view of the system's installation, operation, and performance. The commissioning process does not take away or reduce the responsibility of the installing contractors to provide a finished product, installed and fully functional in accordance with the contract documents.
- B. Commissioning is intended to enhance the quality of system startup and aid in the orderly completion and transfer of systems for beneficial use by the Owner. The CA will be the leader of the commissioning team, planning and coordinating all commissioning activities in conjunction with the design professionals, construction manager, subcontractors, manufacturers, and equipment suppliers.
- C. The General Contractor, Mechanical Contractor, Electrical Contractor, and all Division 22, 23, and 26 subcontractors shall be responsible for cooperating, and coordinating their work, with the CA. They shall also be responsible for carrying out all the physical activities required for installation of components and systems, and operating them during the commissioning process as required in this Section.

1.4 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including general and supplementary conditions, general mechanical provisions, and applicable Divisions 22, 23 and 26 Specification sections, apply to work of this section.

1.5 DEFINITIONS

- A. Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review, and training occur.
- B. Approval: Acceptance that a piece of equipment or system has been properly installed, and is functioning in the tested modes according to the Contract Documents.
- C. Architect/Engineer (A/E): The prime consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.
- D. Owner's Project Requirements: The Owner's Project Requirements is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The Owner's Project Requirements describes the systems, components, conditions, and methods chosen to meet the intent. Some reiterating of the design intent may be included.
- E. Commissioning Authority (CA): An independent authority, not otherwise associated with the A/E team members or the Contractor, though they may be hired as a subcontractor to them. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role. For projects involving LEED EA Credit 3, the CA is neither an employee of, nor contracted through, a contractor or construction manager holding construction contracts.
- F. Commissioning Plan: An overall plan, developed before or after bidding that provides the structure, schedule, and coordination planning for the commissioning process
- G. Construction Checklist (CC): A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Construction checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension correct, oil levels OK, labels affixed, gauges in place, sensors calibrated, etc.). However, some construction checklist items entail simple testing of the function of a component, a piece of equipment, or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The word construction refers to before functional testing. Construction checklists augment and are combined with the manufacturer's startup checklist. Even without a commissioning process, Contractors typically perform some, if not many, of the construction checklist items a commissioning authority will recommend. However, few Contractors document in writing the execution of these checklist items. Therefore, for most equipment, the Contractors execute the checklists on their own. The Commissioning Authority only requires that the procedures be documented in writing and does not witness much of the completion of construction checklists, except for larger or more critical pieces of equipment.

- H. Contract Documents: The documents binding on parties involved in the construction of this Project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.)
- I. Contractor: The general contractor or authorized representative.
- J. Control System: The central building energy management control system.
- K. Data Logging: Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone data loggers separate from the control system.
- L. Deferred Functional Tests: FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that prevent the test from being performed.
- M. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents.
- N. Design Intent: A dynamic document that provides the explanation of the ideas, concepts, and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.
- O. Factory Testing: Testing of equipment on-site or at the factory by factory personnel with a Project Manager present.
- P. Functional Performance Test (FT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation, and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The Commissioning Authority develops the functional test procedures in a sequential written form, coordinates, oversees, and documents the actual testing, which is usually performed by the installing Contractor or vendor. FTs are performed after construction checklists and startup are complete.
- Q. General Contractor (GC): The Contractor for this project. Generally, "GC" refers to all the GC's subs as well. Also referred to as the Contractor, in some contexts.
- R. Indirect Indicators: Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed
- S. Installing Contractor: Contractor who installs specific equipment and/or systems

- T. Manual Test: Using handheld instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”)
- U. Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or the trending capabilities of control systems.
- V. Non-Compliance: See Deficiency.
- W. Non-Conformance: See Deficiency.
- X. Overwritten Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50°F to 75°F to verify economizer operation). See also “Simulated Signal.”
- Y. Owner-Contracted Tests: Tests paid for by the Owner outside the GC’s contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.
- Z. Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.
- AA. Sampling: Functionally testing only a fraction of the total number of identical or near-identical pieces of equipment.
- BB. Seasonal Performance Tests: FTs that are deferred until the system(s) will experience conditions closer to their design conditions.
- CC. Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
- DD. Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance, or pressure to the transducer and DDC system to simulate a sensor value.
- EE. Specifications: The construction specifications of the Contract Documents.
- FF. Startup: The initial starting or activating of dynamic equipment, including executing construction checklists.
- GG. Subs: The subcontractors to the Prime Contractor who provide and install building components and systems.
- HH. Test Procedures: The step-by-step process that must be executed to fulfill the test requirements. The CA develops the test procedures.
- II. Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements for each system are specified in the respective section of the Contract Documents.

- JJ. Trending: Monitoring using the building control system.
- KK. Vendor: Supplier of equipment.
- LL. Warranty Period: Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.6 REFERENCES

- A. All codes and standards refer to the current edition.
- B. ACG Commissioning Guideline
- C. ASHRAE Guideline 0 – The Commissioning Process
- D. ASHRAE 302 – Commissioning Process for Buildings and Systems, 2018
- E. ASTM E336 – Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
- F. ASTM E779 –Standard Test Methods for Determining Air Leakage Rate by Fan Pressurization
- G. NEBB S110 – Whole Building Technical Commissioning of New Construction, 2018.

PART 2 – PRODUCTS

2.1 SYSTEMS TO BE COMMISSIONED

- A. Service water heating systems are to be inspected, tested, signed off as complete and operational, and operated for commissioning agency verification as described in Part 3 of this Section. Work includes checks on installation (including seismic restraints and other accessories), and supply temperature and pressures.
- B. HVAC systems installed under this contract are to be inspected, tested, signed off as complete and operational, and operated for commissioning agency verification as described in Part 3 of this Section. This includes, but is not necessarily limited to, the work listed for each system. The foregoing includes all the following:
 - 1. Duct and Air-Handling Systems: Work includes installation inspections and checks; confirmation of flow balancing completion; leak testing as applicable; seismic restraints installation certification.
 - 2. Refrigeration Compressor/Condensing Unit(s): Work includes installation inspection and checks (including seismic restraints installation certification); checkout and startup by manufacturer's representative as specified; documented performance measurements including capacity, evaporator and condenser pressures, motor current draw, and controls operation. Refer to System Verification checklist.

3. Supply, Return, Relief, and Exhaust Fans, and Air-to-Air Heat Exchanger: Work includes checks on installation (including seismic restraints, dampers, and other accessories), rotation, sound levels, motor current draw, and airflows and pressures. Refer to Pre-Functional Checklists in 2.02.
 4. Air Terminal Devices: Work includes installation inspections and checks; for FCU units, flow adjustments and calibration coordinated with controls and air balancing; controls operation including flow modulation, reheat, controls responses. Refer to System Verification checklist.
- C. Lighting System and Controls: Work includes inspections and checks of installation and operation of all devices; testing documentation; complete operation of all controls sequences, in coordination with commissioning of all controlled systems.
- D. The Contractor shall be responsible for carrying out all work required for commissioning these systems that is defined as a contractor responsibility in Part 3 of this Section.

2.2 SYSTEM VERIFICATION CHECKLISTS

- A. The Contractor will be required to fill out pre-functional checklists or provide startup reports of all mechanical, control, and lighting control systems to the commissioning agent indicating the system is ready for commissioning. If the contractor supplied startup documentation is not adequate for demonstrating compliance, the contractor shall fill out the supplied pre-functional checklists.

2.3 MEMBERS OF THE COMMISSIONING TEAM

- A. The commissioning team will consist of representatives of the following:
1. Architect
 2. Commissioning Agency (CA)
 3. Controls Contractor (ATC)
 4. Electrical (Division 26) Contractor (E)
 5. Electrical Design Engineer
 6. End User
 7. General Contractor [or Construction Manager]
 8. Mechanical (Division 23) Contractor (M)
 9. Mechanical Design Engineer
 10. Owner
 11. Owner's O&M staff
 12. Sheet Metal Contractor
 13. Testing, Adjusting, and Balancing Agency (TAB)

- B. During the commissioning process, participation of team members will generally be required as noted in the following table (with abbreviations as noted in brackets in the preceding list of team members). The mechanical contractor, indicated by “M,” includes all mechanical subcontractors or suppliers whose participation is required for commissioning a particular system or piece of equipment.

EQUIPMENT/SYSTEM DESCRIPTION	TEAM MEMBERS					
	CA	GC	M/P	TAB	ATC	E
Electrical, Water and Gas Metering Systems	X		X		X	X
Envelope Systems	X	X		X		
Exhaust Fan	X	X	X	X	X	X
Fan-Coil Unit	X	X	X	X	X	X
Lighting System and Controls	X			X	X	
Refrigerant Compressor/Condensing Unit	X	X	X		X	X

PART 3 – EXECUTION

3.1 COMMISSIONING SCHEDULE

- A. The Contractor shall hire an independent Commissioning Agency (CA), which will be responsible for scheduling and commissioning all HVAC systems installed under this project.
- B. Prior to the County granting permission for the Contractor to proceed with work in Lab 102, the CA shall complete a full start-up and commissioning of the HVAC system serving Lab 101. At this milestone, the Contractor shall also provide and turn over to the Owner all O&M manuals, as-built drawings, and conduct Owner training.
- C. The Contractor may, at their discretion, commission and start-up additional systems at this stage. However, the County’s intent is to have two separate start-ups and commissioning of the lab systems.
- D. The CA shall schedule and conduct all required on-site meetings to coordinate start-up and commissioning activities. At least one on-site coordination meeting with all involved parties shall be scheduled no later than two (2) weeks prior to pre-startup. Equipment manufacturer representatives shall be present for all system start-ups as well as for Owner training.
- E. All systems must be pre-started, tested, and verified as fully operational prior to conducting training with County staff. Once the CA certifies that the equipment is acceptable and operational, the Owner will require two weeks’ advance notice before training is scheduled.

3.2 COMMISSIONING RESPONSIBILITIES – NON-CONTRACTOR TEAM MEMBERS

- A. Introduction
 - 1. As noted in 2.03, a multi-disciplinary team carries out commissioning. The commissioning responsibilities of some non-contractor team members

during the construction and acceptance phases of the project are provided here for information, and to provide some context for the overall process.

B. Commissioning Agency Responsibilities

1. The commissioning agency will:
 - a. Plan, organize, and implement the commissioning process as specified herein;
2. Prepare the commissioning plan, and ensure its distribution for review and comment; revise the commissioning plan as required during construction; chair commissioning meetings; and prepare and distribute minutes to all commissioning team members, whether or not they attended the meeting;
 - a. In conjunction with the General Contractor, coordinate commissioning activities among all contractors, subtrades, and suppliers;
3. Monitor system verification checks, and ensure the results are documented as the checks are done;
4. Monitor controls point-to-point checks done by the controls contractor, and ensure the results documented as the checks are done;
5. Observe all startups and initial system operations tests and checks;
6. Direct the contractors to operate equipment and systems as required to ensure that all required functional performance tests are carried out for verification purposes;
7. Witness all functional performance tests and document the results;
8. Prepare and submit a Commissioning Report which documents all checks and tests done throughout the Commissioning process, and the results obtained from each; and
9. Ensure all required O&M manuals, instructions and demonstrations are provided to the Owner's designated operating staff.

3.3 MECHANICAL ENGINEER RESPONSIBILITIES

- A. The Mechanical Engineer will review the Commissioning Plan, and will participate, as appropriate, in on-site commissioning meetings.
- B. During the acceptance phase of the commissioning process, the Mechanical Engineer may be on site to review commissioning documentation, to witness functional performance tests, and to analyze the installation and its performance.

3.4 OWNER'S RESPONSIBILITIES

- A. The Owner will ensure the availability of operating staff for all scheduled instruction and demonstration sessions. This staff will possess sufficient skills and knowledge to operate and maintain the installation following attendance at these sessions.

- B. The Owner will also ensure the appropriate involvement of the Electrical Engineer, Architect, and any other consultants as required, in the commissioning process.

3.5 COMMISSIONING RESPONSIBILITIES – GENERAL CONTRACTOR

- A. The General Contractor has responsibility to ensure the overall completion of the Work. In this regard, they shall:
 - 1. Participate as required in the HVAC commissioning process,
 - 2. Ensure the Mechanical Contractor performs all assigned HVAC commissioning responsibilities as specified in 3.6,
 - 3. Ensure the testing, adjusting and balancing agency performs HVAC commissioning responsibilities as listed in 3.7,
 - 4. Ensure the Electrical Contractor performs all assigned HVAC commissioning responsibilities as specified in 3.9, and
 - 5. Ensure the cooperation and participation in the HVAC commissioning process of all other subcontractors as applicable.
- B. The General Contractor shall assign a representative to the commissioning team, and submit the person's name to the commissioning agency, within one (1) month of the award of the contract. The representative shall have the authority to make decisions on behalf of the general contractor as they relate to the organization and scheduling of HVAC commissioning. The representative shall facilitate communications among all contractors and suppliers and other commissioning team members, and shall foster the necessary cooperative action. One specific responsibility shall be to attend commissioning meetings, and ensure action items arising from them are attended to as required to allow the commissioning process to proceed on schedule.
- C. In the event that any scheduled equipment or system startups or functional performance tests are terminated because the CA or the Mechanical Engineer discover deficient or incomplete work, or due to the nonattendance of required contractor or supplier personnel, the contractor or subcontractor responsible for the termination shall also be responsible for paying reasonable costs of time and travel expenses of any or all of the following representatives who were physically present for the purpose of witnessing the startup or the FPT: the CA, the Mechanical Engineer, the Electrical Engineer, and the Owner. The Owner may provide a statement to the General Contractor identifying the specific activity that was terminated, the scheduled date, and a list of those in attendance, along with their reasonable time and travel expense costs.

3.6 COMMISSIONING RESPONSIBILITIES – DIVISIONS AND 23 (PLUMBING AND MECHANICAL) CONTRACTORS

- A. The Mechanical Contractor, Plumbing Contractor, and all the subcontractors and suppliers within Divisions 22 and 23 shall cooperate with the commissioning

agency (CA), and other commissioning team members to facilitate the successful completion of the commissioning process.

- B. The contractor shall assign a representative to the commissioning team, and submit the person's name to the commissioning agency, within one (1) month of the award of the contract. The representative shall have the authority to make decisions on behalf of the Mechanical Contractor as they relate to the organization and scheduling of HVAC commissioning. The representative shall ensure communications between Divisions 22 and 23 contractors and suppliers and all other commissioning team members, and shall foster the necessary cooperative action. One specific responsibility shall be to attend commissioning meetings, and ensure action items arising from them are attended to as required to allow the commissioning process to proceed on schedule.
- C. The Mechanical Contractor, Plumbing Contractor, and all mechanical subcontractors and suppliers shall cooperate with the Commissioning Agency in carrying out the HVAC commissioning process. In this context, the Mechanical Contractor shall:
1. Each contractor and subcontractor in this division shall include in their quotes the cost of participating in the commissioning process as specified herein.
 2. Ensure the automatic temperature controls (ATC) contractor performs HVAC commissioning responsibilities as listed in 3.8.
 3. Provide instruction and demonstrations for the Owner's designated operating staff, in conjunction with the commissioning agency and mechanical engineer, and with the participation of qualified technicians from major equipment suppliers and the controls contractor.
 4. Include requirements for submittal data, O&M data, and training information in each purchase order or subcontract written.
 5. Ensure cooperation and participation of specialty subcontractors such as sheet metal, piping, refrigeration, and water treatment as applicable.
 6. Ensure participation of major equipment manufacturing in appropriate startup, testing, and training activities.
 7. Attend HVAC commissioning meetings scheduled by the CA.
 8. Notify the CA a minimum of two weeks in advance of scheduled equipment and system startups, so that the CA may witness system verifications, and equipment and system startups.
 9. Provide sufficient personnel to assist the CA as required during system verification and functional performance testing.
 10. Prior to startup, inspect, check, and confirm the correct and complete installation of all equipment and systems for which system verification checklists are included in the commissioning plan. Document the results of

all inspections and checks on the checklists and sign them. If deficient or incomplete work is discovered, ensure corrective action is taken and recheck until the results are satisfactory and the system is ready for safe startup.

11. Notify the CA a minimum of two weeks in advance of the time for start of the TAB work.
12. Attend the initial TAB meeting for review of the TAB procedures.
13. Provide equipment and systems startup resources as specified and required. If during an attempted equipment or system startup, deficient or incomplete work is discovered that would preclude safe operation, the startup shall be aborted until corrective action has been taken. Ensure such action is taken and verified before rescheduling a new startup. Those responsible for deficient or incomplete work will be responsible for costs in accordance with 3.5 in this Section.
14. Carry out performance checks to ensure that all equipment and systems fully functional and ready for the CA to witness formal functional performance tests (FPTs).
15. Operate equipment and systems for FPTs in accordance with the commissioning plan and as directed by the commissioning agency. If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, the CA will stop the FPTs. Those responsible for deficient or incomplete work will be responsible for costs in accordance with 3.5 in this Section.
16. Ensure that all corrections necessary for full and complete system operation as specified are completed; then with the ATC contractor and other applicable subcontractors, carry out functional performance checks to confirm correct operation before applying to the CA to reschedule the FPTs for the system in question.
17. Prepare preliminary schedule for mechanical system orientation and inspections; O & M manual submission; training sessions; pipe and duct system testing, flushing, and cleaning; equipment startup TAB, and task completion for use by the CA.
18. Update schedule as appropriate throughout the construction period.
19. Attend initial O&M staff training session.
20. Conduct mechanical system orientation and inspection at the equipment placement completion stage.
21. Update drawings to as-built condition and review with the CA.
22. Gather O & M data on all equipment and assemble in binders as required by the commissioning specification. Submit to CA prior to the completion of construction.

23. Participate in, and schedule vendors and contractors to participate in the O&M staff training sessions as set up by the CA.
24. Provide written notification to the General Contractor [or Construction Manager] and CA that the following work has been completed in accordance with the contract documents and the equipment, systems, and subsystems are operating as required.
 - a. HVAC equipment including all fans, air handling units, dehumidification units, ductwork, dampers, terminals, and all Division 22 and 23 equipment.
 - b. Refrigeration equipment, pumping systems and heat rejection equipment.
 - c. Firestopping in the fire-rated construction, including fire and smoke damper installation, caulking, gasketing, and sealing of smoke barriers.
 - d. Seismic restraints installed to specification; a certification from the seismic restraint engineer meets this requirement.
 - e. Fire detection and smoke detection devices furnished under other divisions of this specification, as they affect the operation of the smoke control systems.
 - f. That the building control system is functioning to control mechanical equipment systems as specified.
- D. Provide a complete set of as-built drawings and O & M manuals to the CA.

3.7 COMMISSIONING RESPONSIBILITIES – TAB AGENCY

- A. With respect to HVAC commissioning, the TAB agency shall:
 1. Include costs for HVAC commissioning requirements in the quoted price.
 2. Attend commissioning meetings scheduled by the CA prior to, and during, on-site TAB work being done.
 3. Submit proposed TAB procedures to the CA and mechanical engineer for review and acceptance.
 4. Attend the TAB planning meeting scheduled by the CA. Be prepared to discuss the procedures that shall be followed in testing, adjusting, and balancing the HVAC system.
 5. At the completion of the TAB work, submit the final TAB report to the General Contractor [or Construction Manager], with copies to the Owner, CA, and Mechanical Engineer. If the TAB work is contracted directly by the Owner, submittal will be to the Owner, CA, and Mechanical Engineer; if contracted directly by the Mechanical Contractor, submittal will be to the Mechanical Contractor, with General Contractor, CA, and Mechanical Engineer notified.

6. Participate in verification of the TAB report by the CA for verification or diagnostic purposes. This will consist of repeating a sample (normally 10% to 20%) of the measurements contained in the TAB report as directed by the CA.
7. Participate in O & M personnel training sessions as scheduled by the CA.

3.8 COMMISSIONING RESPONSIBILITIES – CONTROLS CONTRACTOR

- A. With respect to HVAC commissioning, the Controls Contractor shall:
 1. Include cost for commissioning requirements in the quoted price.
 2. Review design for controllability with respect to equipment selected for the project.
 3. Review and confirm in writing that a proper hardware specification exists to permit functional performance testing as required by specification and sequence of operation.
 4. Review and confirm in writing that proper safeties and interlocks are included in design.
 5. Ensure the proper sizing of control valves and actuators, based on design pressure drops. Ensure that control valve authority will result in capacity control as specified. Include valve sizing and authority information in submittal to Mechanical Engineer.
 6. Ensure the proper sizing of control dampers. Ensure damper authority to control airflows as specified. Review and confirm in writing proper damper positioning for mixing to prevent stratification. Ensure correct actuator vs. damper movement for smooth operation. Include damper sizing, control authority and actuator selection data in submittal to Architect.
 7. Ensure the proper selection of sensor ranges, and include data with submittal to Architect.
 8. Clarify all questions concerning sequences of operation with the Architect.
- B. Attend commissioning meetings scheduled by the CA.
 1. Provide the following submittals to the CA for review:
 - a. Provide all documentation required in the Division 23 submittals including but not limited to:
 - 1) Hardware and software submittals.
 - 2) Control panel construction shop drawings.
 - 3) Diagrams showing all control points, sensor locations, point names, actuators, controllers and where necessary, points of access, all superimposed on diagrams of the physical equipment.

- 4) Narrative description of all control sequences for each piece of equipment controlled.
 - 5) Logic diagrams showing the logic flow of all control sequences.
 - 6) A list of all control points, including analog inputs, analog outputs, digital inputs, and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each standalone control unit.
 - 7) A complete control language program listing including all software routines employed in operating the control system. Also, provide a program write-up, organized in the same manner as the control software. This narrative shall describe the logic flow of the software and the functions of each routine and subroutine. It should also explain individual math or logic operations that are not clear from reading the software listing.
 - 8) Hardware operation and maintenance manuals.
 - 9) Application software and project applications code manuals.
2. Inspect, check, and confirm the proper installation and performance of controls/BAS hardware and software provided by others.
 3. Integrate installation and programming scheduling with construction and commissioning schedules.
 4. Inspect, check, and confirm the correct installation and operation of input and output field points and devices through documented and signed off point-to-point checkouts.
 5. Provide thorough training to operating personnel on hardware operations and programming, and the application program for the system, in accordance with the O&M staff training program in the commissioning plan.
 6. In conjunction with the mechanical contractor, demonstrate system performance to the CA including all modes of system operation (e.g., occupied, unoccupied, and emergency) during the functional performance tests (FPTs). If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, the CA will stop the FPTs. Those responsible for deficient or incomplete work will be responsible for costs in accordance with 3.5 in this Section.
 7. Provide control system technician to assist during system verification and functional performance testing.
 8. Provide support and coordination with TAB contractor on all interfaces between controls and TAB scopes of work. Provide, at no additional cost to the TAB and commissioning agencies, all devices, such as portable operator's terminals and all software for the TAB agency to use in completing TAB procedures.

- 3.9 COMMISSIONING RESPONSIBILITIES – ELECTRICAL (DIVISION 26)
CONTRACTOR
- A. With respect to HVAC commissioning, the electrical contractor shall:
1. Include cost for HVAC, and lighting system commissioning requirements in the quoted price.
 2. Review design with respect to providing power to the equipment and lighting.
 3. Verify that proper hardware specifications exist for functional performance and sequence of operation required by specification.
 4. Verify that proper safeties and interlocks are included in the design of electrical connections for equipment, generator, and lighting.
 5. Attend commissioning meetings scheduled by the CA.
 6. Schedule work so that required electrical installations are completed, and systems verification checks and functional performance tests can be carried out on schedule.
 7. Inspect, check, and confirm in writing the proper installation and performance of all electrical services provided.
 8. Provide electrical system technicians to assist during system verification and functional performance testing as required by the CA.
- B. In addition to HVAC commissioning, the Electrical Contractor shall provide factory startup and support of lighting control systems, to include at a minimum:
1. Include cost for commissioning requirements in the quoted price.
 2. Review design for controllability with respect to equipment selected for the project.
 - a. Review and confirm in writing that a proper hardware specification exists to permit functional performance testing as required by specification and sequence of operation.
 - b. Review and confirm in writing that proper safeties and interlocks are included in design.
 3. Ensure the proper sizing and location of sensors, based on obstruction locations. Ensure the proper selection of sensor ranges, and include data with submittal to Electrical Engineer.
 4. Clarify all questions concerning sequences of operation with the Electrical Engineer.
 5. Attend commissioning meetings scheduled by the CA.
 6. Provide the following submittals to the CA for review:

- a. Provide all documentation required in the Division 26 submittals including but not limited to:
 - 1) Hardware and software submittals.
 - 2) Control panel construction shop drawings.
 - 3) Diagrams showing all control points, sensor locations, point names, actuators, controllers and where necessary, points of access, all superimposed on diagrams of the physical equipment.
 - 4) Narrative description of all control sequences for each piece of equipment controlled.
 - 5) Logic diagrams showing the logic flow of all control sequences.
 - 6) A list of all control points, including analog inputs, analog outputs, digital inputs, and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each standalone control unit.
 - 7) A complete control language program listing including all software routines employed in operating the control system. Also provide a program write-up, organized in the same manner as the control software. This narrative shall describe the logic flow of the software and the functions of each routine and subroutine. It should also explain individual math or logic operations that are not clear from reading the software listing.
 - 8) Hardware operation and maintenance manuals.
 - 9) Application software and project applications code manuals.
7. Inspect, check, and confirm the proper installation and performance of hardware and software provided by others.
8. Integrate installation and programming scheduling with construction and commissioning schedules.
9. Inspect, check, and confirm the correct installation and operation of input and output field points and devices through documented and signed off point-to-point checkouts.
10. Provide thorough training to operating personnel on hardware operations and programming, and the application program for the system, in accordance with the O&M staff training program in the commissioning plan.
11. In conjunction with the Electrical Contractor, demonstrate system performance to the CA including all modes of system operation (e.g., occupied, unoccupied, and emergency) during the functional performance tests (FPTs). If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, the CA will stop

the FPTs. Those responsible for deficient or incomplete work will be responsible for costs in accordance with 3.5 in this Section.

12. Provide control system technician to assist during system verification and functional performance testing.
13. Provide support and coordination with TAB contractor on all interfaces between controls and TAB scopes of work. Provide, at no additional cost to the TAB and commissioning agencies, all devices, such as portable operator's terminals and all software for the TAB agency to use in completing TAB procedures.

END OF SECTION 01 91 13

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**SECTION 03 15 00
CONCRETE ACCESSORIES****PART 1 GENERAL****1.01 DESCRIPTION OF WORK**

- A. The Work specified in this Section includes concrete anchors and miscellaneous embedded items

1.02 REFERENCES

- A. ASTM International (ASTM) Standards:
1. A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 2. C881 Standard Specifications for Epoxy-Resin-Base Bonding Systems for Concrete
 3. D1751 Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types)
 4. F3125 Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

1.03 SUBMITTALS

- A. In accordance with the requirements of Section 01300 – Project Data Submittals, submit the following Project Data:
1. Catalog data for all items covered by this Section to be incorporated in the Work.

PART 2 MATERIALS**2.01 ANCHOR BOLTS**

- A. In accordance with the requirements of Section 01300 – Project Data Submittals, submit the following Project Data:
1. Anchor bolts shall be either drilled anchors or cast-in-place as shown on the Contract Drawings.
 - a. Drilled anchors shall either be epoxy adhesive type or expansion type, torque-controlled, 316 stainless steel, Hilti, Simpson, Rawl, Covert or approved equal. Hole diameter shall be in accordance with manufacturer's instructions. Epoxy for adhesive anchors or dowel embedments shall be a non-sag, two-component epoxy resin conforming to ASTM C881, Type I, IV, or V; Grade 3, Class D, E, or F as required for application between concrete temperatures of 40- and 90-degrees Fahrenheit.
 - b. All anchors shall be male-type projecting anchors unless female-type anchors are specifically called out otherwise. Provide minimum embedment depths shown on the Contract Drawings, but in no case less than minimum manufacturer required embedment. Connected work shall not bear on threads.

PART 3 EXECUTION

3.01 ANCHOR BOLTS

- A. All drilled anchors shall be tensioned using torque wrenches to not less than 50 percent, nor more than 90 percent of rated allowable capacity after installation, in accordance with Manufacturer's instructions.

END OF SECTION 03 15 00

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SECTION 05 12 00 – STRUCTURAL STEEL FRAMING**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

A. Section Includes:

1. Structural steel framing members, support member struts and related items.
2. Base plates, shear stud connectors.

1.2 REFERENCES

A. AISC - Code of Standard Practice - Manual of Steel Construction – Allowable Stress Design (ASD) and Load & Resistance Factored Design (LRFD).

B. ASTM International (ASTM):

1. A36 Standard Specification for Carbon Structural Steel (Channels, Angles & Plates)
2. A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. A108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
4. A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5. A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength (Carbon Steel Externally Threaded Standard Fasteners)
6. A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
(Fy = 46 ksi – HSS Shapes)
7. A563 Standard Specification for Carbon and Alloy Steel
8. A572 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
9. A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
10. A992 Standard Specification for Structural Steel Shapes
(Fy = 50 ksi – Wide Flange Shapes)
11. A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
12. F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

13. F3125 Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

C. AWS D1.1 - Structural Welding Code.

1.3 SUBMITTALS

A. In accordance with the requirements of Section 01 30 00 - Project Data Submittals, submit the following Project Data:

1. Shop Drawings: Submit shop drawings prior to commencing any fabrication of structural steel. Show framing layout, dimensions, connections with adjoining materials and construction, finishes, welds, bolts and fasteners, and anchoring; show field welds, cuts, holes, and fasteners; verify all dimensions; indicate size, type, grade, and camber of all members.
 - a. Indicate welds by standard AWS A2.4 symbols. Show size, length, and type of each weld.
 - b. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
 - c. Include with each detail shown on the shop drawings, a reference to the Architect's and Engineer's drawings and details, where applicable.
 - d. Include with each beam or column a shop drawing location.
2. Certification: Stud Base Qualifications: Shear stud manufacturer shall submit written certification that the stud base has passed the 90-degree bend tests as described in AWS D1.1, Section 7.A. Stud base shall be considered as qualified if, in all required test specimens, fracture occurs in the plate material or shank of the stud and not in the weld.
3. Certificates of Conformance: Submit certificates of conformance or product data for welding electrodes and rods, high-strength bolts and nuts, galvanizing repair compound, shear connection studs, and deformed bar anchors.
4. Testing Agency Reports: Submit the following reports from the fabrication facility to the Engineer.
 - a. Welder Certifications.
 - b. Welding Inspections.
 - c. High-Strength Bolted Connection Inspection.

B. Fabricator shall submit certificate of compliance that the work was performed in accordance with the approved construction documents.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
1. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges".
 - a. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as a part of his preparation of these shop drawings."
 2. AISC "Specifications for the Design Fabrication and Erection of Structural Steel for Buildings."
 3. "Specifications for Structural Joints using F3125 Bolts" approved by the Research Council on Structural Connections.
 4. American Welding Society (AWS) D1.1 "Structural Welding Code--Steel".
 5. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."
 6. Washington Association of Building Officials (WABO).
- B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.
1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification test and are WABO certified.
 2. If recertification of welders is required, retesting will be Contractor's responsibility and expense.
 3. Fabricator's shop shall be registered and approved by the building official for all shop welding procedures to be used.
- C. Allowable Tolerances: Unless otherwise noted on Drawings or specified, provide structural steel work in accordance with the following minimum tolerances:
1. Fabrication Tolerances: In accordance with requirements of AISC "Code of Standard Practice," except as required to maintain the erection tolerances specified herein.
 2. Erection Tolerances: Level and plumb individual members within AISC specified tolerances.
- D. Tests and Inspection: Work is subject to special testing and inspection. The fabricator shall provide the Owner's Inspector access to places where material is being fabricated.

- E. Mill Test Reports: Submit mill test reports on all steel which can be identified to the Inspector verifying compliance with specified requirements as required by regulations and standard specifications.
- F. Fabricator: Company specializing in performing the work of this section with minimum 5 years' experience.
- G. Erector: Company specializing in performing the work of this section with minimum 5 years' experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. If bolts and nuts become dry or rusty, clean and relubricate before use.
 - 1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.
- D. Project/Site Holding and Protection: In assembling and during welding, the component parts shall be held with sufficient clamps or other adequate means to keep parts straight and in close contact. In welding, precautions shall be taken to minimize "lock-up" stress and distortion due to heat. In wind, welding shall be done only after adequate wind protection is furnished and set up.

PART 2 – PRODUCTS**2.1 MATERIALS**

- A. Structural Steel Members: ASTM A36 and ASTM A992 Grade 50 as noted on the structural drawings.
- B. Hollow Structural Section: ASTM A500, Grade B.
- C. Pipe: ASTM A53, Grade B.
- D. Headed Shear Stud Connectors: ASTM A108; Grade C1015, C1017 or C1020. Use Nelson shear Connectors or an approved equal.
- E. High-Strength Bolts, Nuts, and Washers: ASTM F3125 bolts.
- F. Anchor Bolts: ASTM F1554, Grade 36, including ASTM A563, Hex, Grade A, nuts and washers.

- G. Welding Electrodes:
1. Electrodes used for making complete penetration welds shall be of classification that will provide weld metal with a tensile strength not less than that of the base metal being welded.
 2. Electrodes for making fillet, plug, slot, or partial penetration groove welds shall conform to AWS A5.1 or A5.5, E70XX Series.
 3. Use only low hydrogen electrodes for all welding of complete and partial penetration groove welds of ASTM A572 base metal made in the field and for manual shielded metal arc welding of ASTM A36 steel which is more than one inch thick.
- H. Galvanizing: Hot dipped, 1.5 ounces per square foot, galvanize all steel members where noted. Portions of structural steel members that have been field welded or where galvanized material has been damaged during transportation or erection shall be coated with zinc-rich paint such as "Galvacon," or as approved.
- I. Drilled in Concrete Expansion Anchors: Provide size, depth, number, and spacing of anchors as shown in the documents. Provide Stainless Steel anchors where noted. Acceptable expansion anchors shall be Hilti "Kwik Bolt TZ" (carbon steel or stainless-steel type 316, or approved equivalent. Alternative anchor must have a current ICC-ES Evaluation Report. Minimum embedment depth shall be 4.5 times diameter of bolt unless noted otherwise on Drawings.
- J. Deformed Bar Anchors: All deformed steel bar anchors welded to steel for concrete connections shall be "Nelson Deformed Bar Anchors" or approved. All deformed bar anchors shall be automatically end welded in shop or field as recommended by manufacturer of anchors. Deformed bar anchors shall conform to ASTM A1064, with a minimum ultimate tensile strength of 80,000 psi.
- K. Grout: Non-shrink type per Section 03002 - Concrete, Reinforcing Steel, and Grouts.
- L. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

2.2 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final approved shop drawings. Provide camber in structural members where indicated.
1. Properly mark and match-mark materials for field assembly. Fabricate for a delivery sequence that will expedite erection and minimize field handling of materials.
 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

- B. Connections: Weld shop connections, as indicated.
- C. Bolt field connections, except where welded connections or other connections are indicated.
 - 1. Provide high-strength threaded fasteners for all bolted connections, except where unfinished bolts are indicated.
 - 2. At Contractor's discretion, provide unfinished threaded fasteners for temporary bracing to facilitate erection.
- D. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using F3125Bolts."
- E. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correction welding work.
 - 1. Unless specifically permitted in writing by the Engineer, welding processes other than shielded metal arc, submerged arc, gas metal arc, and flux cored arc shall not be used on this project. Electroslag and electrogas welding processes may be used, provided they are qualified by applicable tests.
 - 2. For high-strength, low-alloy steels, follow welding procedures as recommended by steel producer for exposed and concealed connections.
 - 3. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS.
 - 4. The Contractor shall be required to determine procedures and fitup for the specified Complete Penetration Joint Welds.
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions. Provide appropriately sized ferrule for each stud.
- G. Holes in Steel Members: Punch or drill as necessary to receive bolt and similar items. Do not cut holes with a torch. Drill holes in bearing plates. Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing and other specialty items as indicated to receive other work. Bolt holes in steel shall be drilled 1/16" larger in diameter than bolt size used, unless noted otherwise. Bolt holes in steel base plates for anchor bolts shall be drilled 3/16" larger in diameter than anchor bolt size used.

2.3 SHOP FINISH

- A. Surface Preparation: After fabrication, but before erection, clean all surfaces by mechanical or chemical methods, to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. Comply with SSPC-SP2, and SP3.

- B. Galvanizing: Hot dip galvanizing per ASTM A123 or ASTM A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.
- C. Touch-up damaged areas in galvanizing or primer coatings with same materials, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting.
- D. Where surfaces are to be welded or where high strength bolts are used, either mask areas before painting or galvanizing member prior to bolting or welding operation. For galvanized members, the galvanic material may be brushed off in lieu of masking prior to bolting and welding operations.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify existing conditions prior to beginning work.

3.2 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- B. Anchor Bolts:
 - 1. Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
 - 2. Furnish steel templates and other devices as necessary for presenting bolts and other anchors to accurate locations.
- C. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
 - 1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
 - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 - 3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
- D. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

- E. Provide protection during the unloading and erection sequence to minimized damage to the finish materials.
- F. Level and plumb individual members of structure within specified AISC tolerances.
- G. Establish required leveling and plumbing measurements on mean operation temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.
 - 1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Gas Cutting: Do not use gas-cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.
- J. Finish Touchup: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop finish. Apply paint to exposed areas using same material as used for shop painting or zinc-rich paint such as "Galvacon," for galvanized surfaces. Apply by brush or spray to provide minimum dry thickness to match the original application.
- K. Erection Loading: The structural design of the building assumes the elements of the structure to be completely assembled and connected to resist the dead loads, code specified lateral loads, and maximum expected service loads.
 - 1. No consideration has been given to loads, which will be induced by erection procedures or sequencing. The Contractor shall verify, to the satisfaction of himself and the Owner, the ability of the structure's elements to resist all erection loads without exceeding the allowable stresses of the materials used. Where erection loads would overstress the structure, special temporary bracing and strengthening shall be utilized to prevent such overstress during erection.

3.3 BOLTED CONNECTIONS

- A. Except as otherwise indicated on the Drawings or specified, all bolted connections shall be bearing type ASTM F3125 high-strength bolts conforming to the requirements of "Specifications for Structural Joints Using F3125 Bolts".

- B. Install all high-strength bolts in accordance with Section 8, "Installation and Tightening". All bolts are to be fully pretensioned to the requirements of Paragraph 8(d), except those bolts in beam-to-beam connections may be tightened to the snug tight condition of Paragraph 8(c), upon approval of the Owner and structural engineer. In connections requiring fully pretension bolts, per the structural drawings, by direct tension indicating bolts or load indicator washers.
 - 1. Load indicator washers shall be positioned with the protrusions facing the bolt head when the nut is the turning element.
 - 2. If the load indicator is placed under the bolt head and the bolt head is the turning element, then place a hardened flat washer against the load indicator protrusion.
 - 3. When it is required to use the load indicator under the nut, fit a hardened flat washer against the load indicator protrusions before the nut is installed. Either the nut or the bolt may be turned in tightening this assembly.
- C. To avoid excessive galling of soft nuts or steel surfaces, hardened flat washers shall always be used under the nuts of all F3125 bolts 7/8-inch diameter or larger.
- D. None of the above requirements shall relieve the use of hardened flat washers required with short slotted or oversize holes but may be used in conjunction with load indicators.

3.4 FIELD QUALITY CONTROL

- A. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.
 - 1. Promptly notify Engineer whenever design of members and connections for any portion of structure are not clearly indicated.
- B. Inspection:
 - 1. An independent testing laboratory selected by the Engineer and paid by the Owner will perform all tests required for shop and field work except those costs of certain testing and inspection as specified herein shall be paid by the Contractor. All testing shall be in accordance with applicable sections of the IBC, IBC Standards, and as specified herein.

- C. Access to Shop and Field:
1. The contractor shall cooperate in giving advance notice of his operations and shall provide access to the work. Inspection in shop or field shall not relieve the Contractor of his responsibility to furnish satisfactory products. The acceptance of material or finished members by the inspector shall not prevent subsequent rejection if found defective either because of inferior materials or inferior workmanship. Inferior material or workmanship will be subject to rejection unless correction acceptable to the Architect can be made prior to final acceptance of the structure and at no extra cost to the Owner.
 2. Testing agency shall inspect structural steel at plant before shipment. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be in non-compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work and as may be necessary to show compliance of corrected work.
- D. Welding Inspection: All shop and field welding shall be subject to inspection by a qualified welding inspector engaged by the Owner. To determine the quality of welds, the welding inspector shall utilize X- or gamma-ray tests, ultrasonic testing, magnetic particle inspection, and any other aid to visual inspection, which he may deem necessary to assure himself of the adequacy of the welding.
- E. Welds to be Inspected: The following welds shall be inspected by the methods given below by the Owner's inspector.
1. 25 percent of all complete and partial penetration welds shall be checked by radiographic or ultrasonic testing.
 2. All fillet and other remaining welds shall be visually inspected.
 3. Where radiographic testing is performed, it shall consist of one spot test per weld. Where a spot radiographic test shows defects that required repair, the remainder of that weld shall be radiographed at the expense of the Contractor. Each 6-inch increment of weld or fraction thereof shall be considered one weld.
 4. Where ultrasonic testing is performed, the entire weld shall be tested.
- F. Standards of Acceptance: Welds tested by radiographic and ultrasonic methods shall be accepted or rejected in accordance with ASNI/AWS D1.1.
- G. Defective Welds: All welds found defective and repaired shall be reinspected by the same methods originally used and this reinspection shall be paid for by the contractor.

- H. Bolted Connection Inspection:
1. The sizes and grades of bolts shall be inspected by the Owner's inspector to verify conformance with plans and specifications, unless reinspection is required because of products or installation that does not meet specification requirements.
 2. High strength bolted connections shall be inspected in accordance with the specification for "Structural Joints Using F3125 Bolts."
 3. Test a minimum of 10% of bolts in all fully tensioned connections (2 bolts minimum) with a calibrated wrench. Verify that minimum required bolt tension is furnished. Should any bolt in a given connection test below minimum tension required, test all bolts in that connection.
 4. If snug tight bolts are approved for beam-to-beam connections, visually inspect all connections to ensure that plates are brought into contact. Randomly observe bolt-tightening operations to verify that AISC minimum snug tight requirements are complied with.
- I. Shear Connector Studs: Inspect and test stud welding in accordance with AWS D1.1 Section 7.

END OF SECTION 05 12 00

SECTION 05 50 00 – METAL FABRICATIONS**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. This Section covers all miscellaneous iron, steel, aluminum, or other non-ferrous metal work, not specifically described in other sections.

1.2 REFERENCES

- A. American Institute of Steel Construction (AISC) - Manual of Steel Construction, 15th Edition
- B. The Design and Fabrication of Galvanized Products, Zinc Institute, N.Y. 10017, EZ 3 10M 11/73
- C. American Welding Society, Inc. (AWS):
 - 1. Standard B2.1 Specification for Welding Procedure and Performance Qualification
 - 2. Standard D1.1 Structural Welding Code – Steel, latest edition
 - 3. Standard D1.2 Structural Welding Code – Aluminum, latest edition
 - 4. Standard D1.6 Structural Welding Code – Stainless Steel, latest edition
- D. ASTM International (ASTM):
 - 1. A36 Standard Specification for Carbon Structural Steel
 - 2. A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 3. A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - 4. A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - 5. A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar
 - 6. B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 7. F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
 - 8. F3125 Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

1.3 SUBMITTALS

- A. In accordance with the requirements of Section 01 30 00 – Project Data Submittals, submit the following Project Data:
1. Complete detail drawings of all miscellaneous metal items specified herein or shown on the Drawings.
 2. Certification of conformance with ASTM A380 and these specifications for handling, cleaning descaling, and passivation of stainless steel.
 3. Material data and certification for steels and weld electrodes.
 4. Submit welding procedure specifications (WPS) for all welds to be used in the work. WPS shall conform to AWS D1.1, D1.2, or D1.6 as applicable, and to AWS B2.1.
 5. Submit documentation of qualifications and current welding certification for all welders indicating qualifications for welding of steel, aluminum, or stainless steel as applicable.

PART 2 – PRODUCTS**2.1 GENERAL MATERIALS**

- A. Structural Steel: ASTM A36 (rolled shapes), ASTM A500 (tubing), ASTM A53, Grade B (pipe), ASTM A6 (general requirements). Provide hot dipped galvanized coatings where specified in the documents.
- B. Aluminum: ASTM B221, type 6061 or 6063.
- C. Stainless Steel: ASTM A666, Type 316. Use 316L for shapes to be welded. Filler metals for welding shall be matching metal as specified in ANSI/AWS A5.9 Specification for Corrosion-Resisting Chromium and Chromium-Nickel Steel Bare and Composite Metal Cored and Stranded Welding Electrodes and Welding Rods. Minimum 70 ksi tensile strength.
- D. Bolts and Nuts: Bolts and Nuts shall meet the requirements of the following specifications:
1. Anchor Bolts: ASTM F1554 Grade 36 with Class 1A Threads, unless noted otherwise. Furnish anchor rods prefabricated with matching double heavy hex nuts jammed at the end embedded in concrete. Furnish hardened plate washers, lock washers, and matching heavy hex nuts for securing the base plate to the anchor rods. Hooked anchor rods shall not be used except where noted. A rigid steel template shall be used to locate anchor rods while placing concrete. Anchor bolts shall have sufficient length to provide the minimum embedment shown on the drawings, measured from the face of the concrete to the near face of the double nut, with adequate extension as required to receive the base plate with full thread projection for nut installation. Anchor rod installation shall be coordinated with reinforcing and formwork.

- a. Leveling nuts or other means to assure the baseplates are level shall during installation. After base installation, anchor bolt nuts shall be installed to a snug-tight condition. No heating or bending of the anchor rods is permitted. Holes in the base material shall not be enlarged by burning.
1. Expansion Bolts: Bolts, nuts and washers shall be 316 stainless steel; wedges shall be double plated spring steel.
2. Machine Bolts: ASTM A307 or stainless steel where called out on the Drawings or specified. All carbon steel bolts, nuts and washers shall be hot dip galvanized for fabrication of galvanized metals.
3. High-Strength Bolts: ASTM F3125.
- E. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.
- F. Galvanizing: Hot dip galvanizing per ASTM A123 or ASTM A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

2.2 FABRICATION

- A. Workmanship: Conform to accepted shop practices. Form work true to detail, with clean, straight, sharply defined profiles. Unless otherwise shown or specified, finish exposed welds flush and smooth.
- B. Joints and Connections: Weld all joints, unless other fastening methods are shown, specified, or specifically approved. Close fit exposed joints; make joints where least conspicuous. Unless otherwise shown or specified, use flat and countersunk headed bolts or screws in exposed connections.
- C. Cutting, Drilling: Perform coping, cutting, drilling, and punching required for accurate fitting and assembly work. In addition, perform similar operations as required for attachment of work of other trades, provided that directions for such work are supplied prior to project data approval. Where galvanized assemblies, punched holes shall be reamed; use flame cutting rather than cold shearing; avoid cold forming to prevent galvanizing vent holes in closed assemblies in accordance with Zinc Institute recommendations.
- D. Provisions for Attachment to Structure: Furnish miscellaneous metal items complete with framing, supports, hangers, bracing, anchors, and other devices shown, specified or necessary for reinforcement and proper, secure setting or attachment.
- E. Dissimilar Materials Protection: Insulate aluminum surfaces in contact with metals other than galvanized or stainless steel, or with plaster or concrete by means of chromate gasketing or heavy coat of alkali-resistant bituminous paint.
- F. Workmanship: Fabricate all items neatly and rigidly in accordance with the details. Form curved metal neatly to radii indicated. Provide members of sizes

- indicated and weld, bolt, or rivet securely together. Furnish bolts, nuts, washers, and other fastening devices required for anchoring and securing work.
- G. Welding: Use electric shielded-arc process in accordance with Welding Specifications of American Welding Society. Use only welding operators properly trained, highly skilled, and AWS-certified in arc welding. Grind smooth all surface welds exposed to view.
- H. Welds: Comply with requirements of AWS Code for welding procedures and quality of welds, including appearance. Built-up sections: Assemble components and weld using procedures which will maintain proper alignment of finished section. Verify that weld sizes, fabrication sequence, and equipment to be employed will limit distortions to allowable tolerances. Surface bleed of back-side welding on exposed surfaces will not be acceptable. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress all exposed welds.
- I. Surface Preparation: After Fabrication, but before erection, clean all surfaces by mechanical or chemical methods, to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. Comply with SSPC-SP2, and SP3.

PART 3 – EXECUTION**3.1 INSTALLATION**

- A. General: Install work in strict accordance with Drawings. Perform cutting, drilling, and fitting required. Accurately set, place properly, securely attach work in true plans, alignment, plumb and level; properly adequately reinforce and stiffen.
- B. Prime Coat Touchup: After installation of steel items, touch up field bolts, field welds, uncoated connections, and abrasions to shop protective coatings. Clean items of mud, dirt, and other objectionable foreign matter prior to touching up the prime coat and field painting.
- C. Galvanized Items: Items that have been drilled, cut, welded, or otherwise damaged shall be touched up using either of the following products:
1. "Galv-Weld," manufactured by Kenco Division of Southern Coating and Chemical Co., Galv-Weld Products, Sumter, South Carolina. Apply in accordance with manufacturer's instructions and to same thickness as specified hot dip coating.
 2. Hot stick followed by CRC Zinc Re-nu brush-on cold galvanizing compound with epoxy binder. Apply in accordance with manufacturer's instructions.
- D. Aluminum Items: Aluminum items in contact with concrete shall have contact surfaces coated to prevent corrosion. Aluminum items in contact with steel shall be electrically isolated with gaskets and fastener sleeves.

END OF SECTION 05 50 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough opening framing for doors, windows, and roof openings.
- B. Sheathing.
- C. Roof-mounted curbs.
- D. Miscellaneous framing and sheathing.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata.
- C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.
- D. PS 20 - American Softwood Lumber Standard; 2021.
- E. WWPA G-5 - Western Lumber Grading Rules; 2021.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Western Wood Products Association; WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.

2.03 EXPOSED BOARDS

- A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
- B. Moisture Content: Kiln-dry (15 percent maximum).
- C. Surfacing: S4S.
- D. Species: Douglas Fir.
- E. Grade: No. 2, 2 Common, or Construction.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

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

3.02 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes, AWC (WFCM) Wood Frame Construction Manual, and _____.
- E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.04 ROOF-RELATED CARPENTRY

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

3.05 TOLERANCES

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

END OF SECTION

SECTION 06 10 10 ROUGH CARPENTRY**PART 1 – GENERAL****1.1 DESCRIPTION OF WORK**

- A. This Section covers rough carpentry for wood framing, beams, nailers, blocking, and sheathing.

1.2 REFERENCES

- A. Comply with provisions of the current versions of the following codes, specifications, and standards, except when otherwise indicated:
 - 1. Lumber: U.S. Department of Commerce (DOC) PS 20, American Softwood Lumber Standard
 - 2. Plywood: U.S. Department of Commerce PS 1 Construction and Industrial Plywood
 - 3. Installation: American Forest and Paper Association (AFPA), WFCM-01 Wood Frame Construction Manual, and 2021 International Building Code (IBC) Chapter 23

1.3 SUBMITTALS

- A. Submit copies of the following Project Data in accordance with Section 01 30 00 – Submittals:
 - 1. Catalog data and documentation that all lumber and composite lumber materials conform to the appropriate standards and these specifications.

PART 2 – PRODUCTS**2.1 LUMBER**

- A. General: Factory mark each piece of lumber with type, grade, mill, and grading agency. Nominal sizes are indicated on the Drawings. Provide actual sizes per DOC PS20. All lumber shall be S4S with maximum 19 percent moisture content at time of dressing.
- B. Grades and Species: Provide lumber of the grades and species shown on the Drawings.
- C. Lumber in contact with the following shall be pressure treated with ammoniacal copper zinc arsenate (ACZA) meeting ASTM D1325 and to the standards for the intended use per ASTM D1760.
 - 1. Gutter and flashing.
 - 2. Vapor barriers and waterproofing.
 - 3. Masonry and/or concrete.

2.2 PLYWOOD

- A. General: Identify each plywood panel with the appropriate APA trademark.

- B. Sheathing: APA rated sheathing, exterior classification, 5/8-inch thickness minimum, unless otherwise noted on the drawings, span rating 24/0, five ply minimum.
- 2.3 BOLTS, NAILS, LAG SCREWS, ETC.
- A. At interior plywood wall backing, provide United States Gypsum, Type S-12 screws, bulge head, pilot point, 1-15/16-inch long. At other locations, provide standard manufactured items. Type, size, and number as required to develop full strength of framing member; all bolts, nails, lag screws, etc. shall be galvanized.
- 2.4 MOISTURE CONTENT
- A. Not to exceed 19 percent for dimensional lumber and 18 percent for plywood, unless more restrictive requirements are specifically noted.
- 2.5 SAWN STRUCTURAL PLATES
- A. Douglas Fir No. 1 and better, pressure treated at all locations.
- 2.6 FASTENERS
- A. Where rough carpentry is exposed to weather, in ground contact, or in area of relative high humidity, provide fasteners of American Iron and Steel Institute (AISI) Type 304 stainless steel.
 - B. Nails, Wire, Brads, and Staples: FS FF-N-105.
 - C. Power-Driven Fasteners: National Evaluation Report NER-272.
 - D. Wood Screws: ANSI B18.6.1.
 - E. Lag Bolts: ANSI B19.2.1.
 - F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers.
 - G. Steel Connectors: Steel straps, ties, anchors, hangers and holddowns shall be Simpson Strong-Tie, galvanized.

PART 3 – EXECUTION

3.1 GENERAL

- A. Verify all dimensions and conditions before proceeding. Provide erection bracing as necessary until permanent support and stiffening are installed. Carefully lay out, cut, fit, and install rough carpentry items. Use sufficient nails, spikes, screws, and bolts to ensure rigidity and permanence. Drive nails perpendicular to grain of wood in lieu of toe-nailing, where feasible. Provide for installation and support of plumbing, heating, and ventilating work. Install work to true lines, plumb and level, unless indicated otherwise. Use metal plugs or inserts for attaching to masonry or concrete.

3.2 WOOD FRAMING

- A. Install wood framing in accordance with the AFPA WFCM-01. Anchor and nail in compliance with the Recommended Nailing Schedule of the AFPA WFCM-01 and Table 2304.9.1 Fastening Schedule of the 2021 IBC, whichever is greater. All stud framing shall be spaced 16 inches O.C.

3.3 PLYWOOD

- A. Install plywood in accordance with Form No. E304, APA Design/Construction Guide – Residential and Commercial.
- B. Cover ceiling plywood seams with 2 inch wide veneer strips to match color of plywood. Glue into place and provide square end cuts at corners and splices.

3.4 SAWN STRUCTURAL PLATES

- A. Nominal 2-inch-thick, full width of framing member. Unless indicated otherwise on the Drawings, anchor with ½-inch-diameter expansion bolts at 4-foot centers and 1 foot from each piece; end on single plates at concrete. Stagger ends on double plates.

3.5 WOOD PRESERVATIVE

- A. All wood in continuous contact with concrete or masonry shall be pressure treated. Apply liberal brush coat of same material to surfaces cut in the field or bolt holes drilled in field.

3.6 STEEL CONNECTORS

- A. Unless otherwise detailed on the Contract Drawings, provide not less than the minimum nailing or bolting specified in the manufacturer's catalog for steel connectors.

END SECTION 06 10 10

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SECTION 07 01 50.19 - ROOF PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Patching existing roof system at penetrations with components removed by project scope.

1.02 RELATED REQUIREMENTS

- A. Section 07 62 00 - Sheet Metal Flashing and Trim: Replacement of flashing and counterflashings.

1.03 REFERENCE STANDARDS

- A. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004 (Reapproved 2020).

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

1.05 FIELD CONDITIONS

- A. Existing Roofing System: metal panel roofing.

1.06 WARRANTY

- A. Existing Warranties: Perform this work using methods and materials that will maintain existing roof system warranties.
 - 1. Notify existing roof system warrantor prior to starting this work and obtain written instructions for procedures necessary to maintain this existing warranty.
 - 2. Upon completion of this work, notify warrantor of reroofing completion and obtain documentation to verify that existing roofing system has been inspected and warranty is still in effect.
 - a. Submit documentation upon project closeout.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Patching Materials: Use sheet metal of the same material and same gauge (or thicker) as the existing roof panels.
- B. Temporary Roofing Protection Materials:
 - 1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

2.02 ACCESSORIES

- A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.
- B. Sheathing Paper: Red rosin paper type, at least 3 lb/100 sq ft (1.36 kg/9.3 sq m).
- C. Primer: For enhancing sealant adhesion, use a compatible metal primer.
- D. Sealants:
 - 1. High-Performance Urethane Sealant: For adhering the patch and sealing the perimeter.
 - 2. Reinforcing Fabric and Elastomeric Coating: For repairs involving leaky seams or small holes without a metal patch

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing roof surface has been cleared of materials being removed from existing roofing accessories and ready for next phase of work as required.

3.02 PREPARATION

- A. Sweep roof surface clean of loose matter.
- B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

- A. Remove only existing roofing materials that can be replaced with new materials the same day.
- B. Remove metal counter flashings.
- C. Remove damaged portions of roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets, insulation vents, and hoods.
- D. Repair existing wood deck surface to provide smooth working surface for new roof system.

3.04 INSTALLATION

- A. Cut the Patch: Cut the new metal patch to overlap the damaged area by at least 2 inches on all sides. Round the corners to prevent warping and sharp edges
- B. Install the Patch: Apply a continuous bead of urethane sealant to the perimeter of the damaged area. Press the metal patch firmly into the sealant, ensuring an even squeeze-out around the edges. Secure the patch with corrosion-resistant screws every 3 to 4 inches, located about an inch from the edge. Do not overdrive the screws. Apply a final layer of sealant to the screw heads and edges, smoothing it to create a uniform, watertight seal.
- C. Finishing: Allow sealant to cure according to manufacturer's recommendations. Apply the specified finish coating to the repaired area, blending it with the existing roof.

3.05 FIELD QUALITY CONTROL

- A. Inspect the work to ensure no gaps or voids in the sealant remain

END OF SECTION

SECTION 07 21 19 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.
 - 1. In underside of roofs and ceilings.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- C. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Foamed-In-Place Insulation:
 - 1. BASF Corporation; WALLTITE US Series Closed Cell: www.spf.basf.com/#sle.
 - 2. Carlisle Spray Foam Insulation; _____: www.carlisesfi.com/#sle.
 - 3. Gaco Western; _____: www.gaco.com/#sle.
 - 4. Johns Manville; JM Corbond High Yield Open-Cell: www.jm.com/#sle.
 - 5. NCFI Polyurethanes; _____: www.ncfi.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

- A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Thermal Resistance: R-value (RSI-value) of 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.
 - 2. Water Vapor Permeance: Vapor retarder; 2 perms (115 ng/(Pa s sq m)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.

3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
4. Air Permeance: 0.04 cfm per square foot (0.2 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
5. Closed Cell Content: At least 90 percent.
6. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
7. Basis of Design:
 - a. Carlisle Spray Foam Insulation; SealTite PRO One Zero:
www.carlisesfi.com/#sle.
8. Other Acceptable Products:
 - a. BASF Corporation; WALLTITE US: www.spf.basf.com/#sle.
 - b. Huntsman Building Solutions; ProSeal HFO:
www.huntsmanbuildingsolutions.com/#sle.
 - c. Johns Manville; JM Corbond III Closed Cell Spray Polyurethane Foam:
www.jm.com/#sle.
9. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

- A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete before insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.02 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.

3.04 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, sheet metal roofing, exterior penetrations, _____, and other items indicated in Schedule.
- B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).
- G. CDA A4050 - Copper in Architecture - Handbook; current edition.
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

PART 2 PRODUCTS**2.01 SHEET MATERIALS**

- A. Anodized Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 20 gauge, 0.032 inch (0.81 mm) thick; clear anodized finish.
- B. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch (1.02 mm) thick; plain finish shop pre-coated with silicone modified polyester coating.
 - 1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.
 - 2. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
 - 3. Color: As selected by Construction Manager from manufacturer's standard colors.

2.02 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.

- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel.
Return and brake edges.

2.03 FLASHING

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.04 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer Type: Zinc chromate.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 71 00 - ROOF SPECIALTIES**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Manufactured roof specialties, including fascias.

1.02 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.
- C. NRCA (RM) - The NRCA Roofing Manual; 2025.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Roof Edge Flashings and Copings:
 - 1. Architectural Products Co; _____: www.archprod.com/#sle.
 - 2. ATAS International, Inc; Rapid-Lok Fascia: www.atas.com/#sle.
 - 3. Metal Roofing Systems, Inc; Rapid Lock Coping: www.metalroofingsystems.biz/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Pipe and Penetration Flashings:
 - 1. Elmdor; _____: www.elmdor.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Counterflashings:
 - 1. ATAS International, Inc; _____: www.atas.com/#sle.
 - 2. Hickman Edge Systems; _____: www.hickmanedgesystems.com/#sle.
 - 3. Metal-Era Inc; _____: www.metalera.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

- A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
 - 1. Configuration: Fascia, cant, and edge securement for roof membrane.
 - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
 - 3. Material: Formed aluminum sheet, 0.050 inch (1.3 mm) thick, minimum.
 - 4. Color: As selected by Construction Manager from manufacturer's standard range.
 - 5. Products:
 - a. Hickman Edge Systems; Drip Edge Fascia: www.hickmanedgesystems.com/#sle.
 - b. Metal-Era Inc; Anchor-Tite Drip Edge: www.metalera.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Pipe and Penetration Flashing: Base of rounded aluminum, compatible with sheet metal roof systems, and capable of accomodating pipes sized between 3/8 inch (9.5 mm) and 12 inches (305 mm).

1. Caps: EPDM.
 2. Color: As indicated on drawings.
- C. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- D. Counterflashings: Factory fabricated and finished sheet metal that overlaps top edges of base flashing by at least 4 inches (102 mm), and designed to snap into through-wall flashing or reglets with lapped joints.
1. Finish: Mill finish aluminum.
 2. Color: To be selected by Construction Manager from manufacturer's standard range.

2.03 FINISHES

- A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.04 ACCESSORIES

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.
- B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.
- C. Insulation Board Adhesive: Two-component, low-rise polyurethane foam adhesive used for adhering insulation to low slope roof deck materials.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

END OF SECTION

SECTION 07 84 00 - FIRESTOPPING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Firestopping systems.

1.02 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.
- C. ITS (DIR) - Directory of Listed Products; Current Edition.
- D. FM (AG) - FM Approval Guide; Current Edition.
- E. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- F. UL (FRD) - Fire Resistance Directory; Current Edition.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
 - 2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
 - 3. CEMCO; HOTROD Type-X Compressible Firestopping: www.cemcosteel.com/#sle.
 - 4. Fire Shield, LLC; Barri-Ring: www.fireshieldlv.com/#sle.
 - 5. Hilti, Inc: www.hilti.com/#sle.
 - 6. Nelson FireStop Products; _____: www.nelsonfirestop.com/#sle.
 - 7. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.

2.02 MATERIALS

- A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

- A. Penetrations Through Floors or Walls By:
 - 1. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 1 Hour Construction: UL System C-AJ-1039; RectorSeal MetaCaulk 950.
 - 2. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
 - 3. HVAC Ducts, Uninsulated:
 - a. 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.05 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.

1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- G. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Backing material recommended by sealant manufacturer.
 - 4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 5. Substrates the product should not be used on.
- C. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

1.04 QUALITY ASSURANCE

- A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Allow sufficient time for testing to avoid delaying the work.
 - 4. Deliver sufficient samples to manufacturer for testing.
 - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. Dow: www.dow.com/#sle.
 - 2. Sika Corporation: www.usa.sika.com/#sle.

3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 1. Exterior Joints:
 - a. Seal open joints except open joints indicated on drawings as not sealed.
 2. Interior Joints:
 - a. Seal open joints except specific open joints indicated on drawings as not sealed.
 3. Do Not Seal:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be covered with expansion joint cover assemblies.
 - c. Joints where sealant installation is specified in other sections.
 - d. Joints between suspended ceilings and walls.
- B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.
 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, noncuring.
 2. Lap Joints between Manufactured Metal Panels: Butyl rubber, noncuring.
- C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
 1. Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.04 NONSAG JOINT SEALANTS

- A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 1. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 2. Color: To be selected by Construction Manager from manufacturer's standard range.
 3. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
 4. Products:
 - a. Dow; DOWSIL 756 SMS Building Sealant: www.dow.com/#sle.
 - b. Dow; DOWSIL 790 Silicone Building Sealant: www.dow.com/#sle.
 - c. Dow; DOWSIL 791 Silicone Weatherproofing Sealant: www.dow.com/#sle.
 - d. Sika Corporation; Sikasil WS-290: www.usa.sika.com/#sle.
 - e. Sika Corporation; Sikasil WS-295: www.usa.sika.com/#sle.
 - f. Sika Corporation; Sikasil 728NS: www.usa.sika.com/#sle.
 - g. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
 - h. Tremco Commercial Sealants & Waterproofing; Spectrem 2: www.tremcosealants.com/#sle.
 - i. Tremco Commercial Sealants & Waterproofing; Spectrem 3: www.tremcosealants.com/#sle.

- j. Tremco Commercial Sealants & Waterproofing; Tremsil 600:
www.tremcosealants.com/#sle.
- k. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Tamper-Resistant, Silyl-Terminated Polyether (STPE) and Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus ___ percent, minimum
 - 2. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Construction Manager from manufacturer's standard range.
 - 4. Products:
 - a. Sika Corporation; SikaHyflex-150 LM: www.usa.sika.com/#sle.
- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus ___ percent, minimum.
 - 2. Color: To be selected by Construction Manager from manufacturer's standard range.
 - 3. Products:
 - a. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
 - b. Sika Corporation; Sikaflex-15 LM: www.usa.sika.com/#sle.
 - c. Tremco Commercial Sealants & Waterproofing; Dymonic 100:
www.tremcosealants.com/#sle.
- D. Type ___ - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
- E. Type ___ - Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.

2.05 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- H. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- J. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- K. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.

3. Deansteel Manufacturing Company, Inc; Hollow Metal Doors - SP Series:
www.deansteel.com/#sle.
4. Fleming Door Products, an Assa Abloy Group company:
www.assaabloydss.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 4. Door Edge Profile: Manufacturers standard for application indicated.
 5. Typical Door Face Sheets: Flush.
 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gauge, 0.032 inch (0.8 mm), minimum.
 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
 4. Weatherstripping: Manufacturers standard exterior weatherstripping.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Knock-down type.

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

1. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
2. Weatherstripping: Manufacturers standard exterior weatherstripping

2.05 FINISHES

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

2.06 ACCESSORIES

- A. Glazing: Insulating Glazing Units: As specified in Section 08 80 00, factory installed.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 08 71 00.
- D. Comply with glazing installation requirements of Section 08 80 00.

END OF SECTION

SECTION 08 45 23 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES - KALWALL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic (FRP) sandwich panel system and accessories.
 - 1. Roof panel system.

1.02 RELATED REQUIREMENTS

- A. Section 07 25 00 - Weather Barriers: Sealing perimeter frame to weather barrier installed on adjacent construction.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between perimeter frame and adjacent construction.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1910, Subpart D - Walking-Working Surfaces, 1910.21-1910.30; Current Edition.
- B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- E. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions; 2016.
- F. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
- G. ASTM D1002 - Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal); 2010 (Reapproved 2019).
- H. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials; 2012 (Reapproved 2020).
- I. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2023.
- J. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2022.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- L. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.
- M. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- N. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

- O. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- P. ASTM E661 - Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads; 2022.
- Q. ASTM E972 - Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight; 1996 (Reapproved 2021).
- R. ASTM E2707 - Standard Test Method for Determining Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure; 2015.
- S. ICC-ES AC05 - Acceptance Criteria for Sandwich Panel Adhesives; 2009, with Editorial Revision (2020).
- T. ICC-ES AC177 - Acceptance Criteria for Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems; 2014, with Editorial Revision (2018).
- U. ISO/IEC 17065 - Conformity Assessment - Requirements for Bodies Certifying Products, Processes and Services; 2012.
- V. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
- W. NFRC 201 - Procedure for Interim Standard Test Method for Measuring the Solar Heat Gain Coefficient of Fenestration Systems Using Calorimetry Hot Box Methods; Current Edition.
- X. NFRC 202 - Procedure for Determining Translucent Fenestration Product Visible Transmittance at Normal Incidence; Current Edition.
- Y. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.
- Z. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.
- AA. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, profiles, span analysis data, and component finishes.
- B. Shop Drawings: Include plans, elevations, and details.
- C. Samples:
 - 1. For each exposed finish required, matching thickness and material indicated for this work with size of 7 by 12 inches (178 by 305 mm).
 - 2. For factory-finished aluminum at 3 inches (76 mm) long.
- D. Test Reports: Include the following product test reports from qualified independent testing agency indicating that each type and class of panel system complies with performance requirements indicated, based on comprehensive testing of these products. Reports completed for previous projects are also acceptable when for current manufacturer and relating to products used on this project.
 - 1. ICC-ES Acceptance Criteria; ICC-ES AC177.
 - 2. Flame Spread and Smoke Developed Index; UL 723.

3. Rate and/or Extent and Time of Burning; ASTM D635.
 4. Color Difference; ASTM D2244.
 5. Burglary Resisting Glazing; UL 972.
 6. Bond Tensile Strength of Sandwich Construction; ASTM C297/C297M.
 7. Bond Shear Strength; ASTM D1002.
 8. Panel Beam Bending Strength; ASTM E72.
 9. Panel U-factor; NFRC 100.
 10. Visible Light Transmittance (VLT), Translucent; NFRC 202 or ASTM E972.
 11. Solar Heat Gain Coefficient (SHGC); NFRC 201 calculation.
 12. Condensation Resistance Factor; AAMA 1503.
 13. Air Leakage; ASTM E283/E283M.
 14. Structural Performance; ASTM E330/E330M.
 15. Water Penetration; ASTM E331.
 16. Fire Penetration of Exterior Wall Assemblies; ASTM E2707.
 17. Daylight Modeling Report.
 18. Roof Panel Fall-Through Resistance; ASTM E661.
 19. Roof Covering Burning Brand, Class A; ASTM E108.
- E. Installation Instructions: Special installation requirements.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Warranty Documentation: Manufacturer's sample warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufactured material and products by company continuously and regularly employed in manufacture of specified materials for period of at least ten consecutive years, and with documented evidence of those materials being satisfactorily used on at least six projects of similar size, scope, and location, and at least three of these projects having been in successful use for ten years or longer.
1. Listed panel system by certification agency complying with ISO/IEC 17065, that requires quality control inspections and fire, structural, and water infiltration testing of sandwich panel systems by accredited testing agency.
 2. Conduct quality control inspections at least once each year that include manufacturing facilities, sandwich panel components, and production sandwich panels to ensure product complies with ICC-ES AC177 requirements.
- B. Installer Qualifications: Experienced installer that has been installing Kalwall panel systems for at least two consecutive years and that also provides documented evidence of satisfactory completion of projects of similar size, scope, and type.

1.06 WARRANTY

- A. Provide manufacturer's and installer's written warranties agreeing to repair or replace panel system that fails in material or workmanship within one-year after Date of Delivery. Failure of material or workmanship includes deterioration of finish on metal in excess of normal weathering; defects in accessories, insulated and translucent sandwich panels, and other components of this work.
- B. Extended Panel Warranty:

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1. Provide 10-year limited warranty from Date of Delivery covering delamination affecting structural strength, noticeable surface fiber exposure of exterior panel face, and abnormal color change of exterior face sheet.
2. Provide 20-year limited warranty from Date of Delivery against external exposure of reinforcing glass fibers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. This specification is based on products manufactured by Kalwall Corporation. Other manufacturers may bid this project subject to compliance with performance requirements as indicated and required submittals. Listing other manufacturer's names in this specification does not constitute approval of their products or relieve them of compliance with performance requirements as indicated.
 1. Kalwall Corporation:
 - a. Telephone: (800) 258-9777.
 - b. Fax: (603) 627-7905.
 - c. Email: info@kalwall.com.
 - B. Fiberglass-Sandwich-Panel Assemblies Manufacturers:
 1. Kalwall Corporation; Skyroofs - Translucent Roof Systems:
www.kalwall.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Manufacturer responsible for configuration and fabrication of complete panel system.
- B. Structural Roof Loads: Provide system capable of handling the following loads:
 1. Live Load: 20 psf (.96 kPa).
 2. Snow Load: 45 psf (2.15 kPa).
- C. Air Leakage: Limit to allowable air leakage through panel system assembly with pressure difference across assembly at 6.24 psf (300 Pa) in accordance with ASTM E283/E283M.
- D. Water Leakage: None, when measured in accordance with ASTM E331 at test-pressure difference of 15 psf (730 Pa).
- E. Structural Performance Testing by Uniform Static Air Pressure Difference: Comply with ASTM E330/E330M.
- F. Panel Beam Bending Strength: Less than 1.9 inch (48.3 mm) deflection at 30 psf (1.44 kPa) loading and 10 ft (3.05 m) span without supporting frame in accordance with ASTM E72 test method.
- G. Exterior Face Sheet Strength: Uniform in strength and impenetrable by handheld pencil and as follows:
 1. Ball Impact Test: Pass, based on repelling impact without fracture or tear by at least 70 ft lbf (95 Nm) from 3-1/4 inch (82.6 mm) diameter 5 lb (2.3 kg) free-falling ball in accordance with UL 972 testing.
- H. Fire Penetration Resistance of Wall Assembly: Panels comply with conditions of acceptance in accordance with ASTM E2707.
 1. Absence of flame penetration through wall assembly at any time.

2. Absence of glowing combustion on interior surface of assembly at end of 60-minute observation period.
3. Absence of flame, glow, and smoke when test is terminated prior to completion of 60-minute observation period.
- I. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 110 degrees F (43 degrees C) over 12-hour period without causing detrimental effect to system components.
- J. Roof Panel System Assembly:
 1. Comply with UL 790 or ASTM E108 for Class A Roof Burning Brand test.
 2. Fall Through Protection: Comply with fall through protection requirements of 29 CFR 1910, Subpart D and test methods of ASTM E661; systems requiring supplemental screens or railings are not permitted.

2.03 COMPONENTS

- A. Roof System: Sandwich panels of fiberglass-reinforced-plastic (FRP), translucent face sheets laminated to grid core with mechanically interlocking I-beams and straight adhesive bonding line that covers entire width of I-beam having neat, sharp edge, and protection of exterior face sheet provided with integral, embedded-glass erosion barrier.
 1. Panel Width: As indicated on drawings.
 2. Panel Length: As indicated on drawings.
 3. 2-3/4 inches (70 mm) Thick, Nhermally Broken Aluminum I-Beam Grid Core: Aluminum having 6063-T6 or 6005-T5 alloy and temper complying with ASTM B221 (ASTM B221M), mechanically interlocking muntin-mullion and perimeter, and minimum I-beam width of 7/16 inch (11.1 mm).
 - a. Panel Type: Flat.
 - b. Panel Fill Insulation:
 - 1) Fiberglass batt, low level (Insulation Option #1).
 - c. Thermal Transmittance (U-factor) of FRP Sandwich Panel: 0.29 (1.65), when tested in accordance with NFRC 100.
 - d. FRP Face Sheet Color: Exterior - Crystal/Interior - White.
 - e. Visible Light Transmission (VLT): For face sheet combination indicated and the following panel fill material, when tested in accordance with NFRC 202 or ASTM E972.
 - 1) Fiberglass Batt, Low: 26 percent.
 - f. Solar Heat Gain Coefficient (SHGC): When tested in accordance with NFRC 201 at 0 degrees F (minus 18 degrees C) on cold side for face sheet combination indicated and the following panel fill material.
 - 1) Fiberglass Batt, Low: 0.30, nominal.
 - g. Grid Core Pattern:
 - 1) Shoji: 12 inches wide by 24 inches high (300 mm wide by 600 mm high).
- B. Face Sheets:
 1. Translucent Face Sheets: Fabricated using glass fiber reinforced thermoset resins, and formulated specifically for architectural use.

- a. Use of thermoplastic, e.g., polycarbonate and acrylic, for face sheets is not permitted.
- b. Deformation, deflection, or dripping of face sheets upon exposure to fire is not permitted.
2. Exterior Face Sheet:
 - a. Thickness: As required for system characteristics indicated; 0.070 inch (1.778 mm), minimum.
 - b. Color as indicated under system description.
 - c. Color Stability: Color of exterior face sheet to not change color more than three CIE Units DELTA E in accordance with ASTM D2244 after 5 years outdoors in South Florida weathering facing south; color stability not affected by abrasion or scratching.
3. Interior Face Sheet:
 - a. Thickness: As required for system characteristics indicated; 0.045 inch (1.143 mm), minimum.
 - b. Color as indicated under system description.
 - c. Provide exposed surface of interior face sheets with following flame spread index (FSI) and smoke developed index (SDI) in compliance with ASTM E84 or UL 723.
 - 1) Class B: Flame spread index (FSI) of 50 or less and smoke developed index (SDI) of 250 or less.
 - d. Provide Class CC1 face sheets with burning extent of 1 inch (25.4 mm) or less when tested in accordance with ASTM D635.
- C. Laminate Adhesive: Provided for adhering translucent panel face sheets to grid core; heat and pressure resistant resin-type adhesive for use with structural sandwich panels and designed for at least 25 years of field use, and complying with testing requirements of ICC-ES AC05.
 1. Tensile Strength: At least 750 psi (5.17 MPa) when panel assembly is tested in accordance with ASTM C297/C297M test method after two exposures to six cycles each of accelerated aging conditions complying with ASTM D1037.
 2. Shear Strength: Panel adhesive complying with ASTM D1002 upon exposure to the following conditions:
 - a. Exposed to 50 percent Relative Humidity (RH) at 68 degrees F (20 degrees C), minimum shear strength of 540 psi (3,723 kPa).
 - b. Exposed to temperature of 182 degrees F (83 degrees C), minimum shear strength of 100 psi (689 kPa).
 - c. Exposed to accelerated aging complying with ASTM D1037, minimum shear strength of 800 psi (5.52 MPa), tested at room temperature.
 - d. Exposed to accelerated aging complying with ASTM D1037, minimum shear strength of 250 psi (1.72 MPa), tested at 182 degrees F (83 degrees C).

2.04 PERIMETER CLOSURE SYSTEM

- A. Closure Aluminum Clamp-Tite Installation System:

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1. Roof Closure System: Provide extruded aluminum having 6063-T5 or 6063-T6 alloy and temper in compliance with ASTM B221 (ASTM B221M), and clamp-tite screw type closure system.
- B. Water-Resistive Barriers: To suit application, nonbleeding and nonstaining; see Section 07 25 00.
- C. Sealant for Within Translucent Assembly: As required by manufacturer; see Section 07 92 00.
- D. Sealing Tape: Manufacturer's standard; factory applied to closure system under controlled conditions.
- E. Fasteners: Stainless steel 300 Series screws for aluminum closures; excluding final fasteners to building.
- F. Sill Flashing Sealant: Elastomeric, silicone, or polyurethane and compatible with flashing material; see Section 07 92 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrates, supporting structure, and installation conditions.
- B. Verify dimensions, tolerances, and method of attachment with other work.
- C. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Metal Protection:
 1. At locations where aluminum contacts dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape as recommended by manufacturer for this purpose.
 2. At locations where aluminum contacts concrete, masonry, or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

3.03 INSTALLATION

- A. Install panels within assembly in accordance with manufacturer's fabrication drawings and written installation instructions.
 1. Anchor component parts securely in place using permanent mechanical attachment system.
 2. Allow for thermal and mechanical movement of assembly components.
 3. Seal aluminum clamp-tite installation system as indicated on manufacturer's fabrication drawings and written installation instructions.
- B. Install joint sealants at perimeter joints and within panel assembly in accordance with manufacturer's fabrication drawings and written installation instructions; see Section 07 92 00.

3.04 CLEANING

- A. Remove protective material from prefinished aluminum surfaces.

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- B. Wash down interior and exterior surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths; remove dirt from corners and wipe surfaces clean.

END OF SECTION

SECTION 08 51 13 - ALUMINUM WINDOWS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Extruded aluminum windows with fixed sash.
- B. Factory glazing.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood perimeter shims.
- B. Section 07 25 00 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.
- D. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022.
- B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- C. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2021.
- D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- F. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- K. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).
- L. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).
- M. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2023.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.

- C. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Evidence of WDMA Certification.
 - 3. Evidence of CSA Certification.
 - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- D. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Specimen warranty.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
- B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.08 WARRANTY

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Winco Window Company Series 1450HR.
- B. Other Acceptable - Aluminum Window Manufacturers:
 - 1. Centerline Systems; Vision Craft Fixed and Projecting Windows - Series 2500: www.centerlinesystems.net/#sle.
 - 2. DeSCo Architectural, Inc; i65 Series: www.descoarc.com/#sle.

3. ES Windows; ES-P250: www.eswindows.com/#sle.
4. EXTECH/Exterior Technologies, Inc; TECHVENT 5300: www.extechinc.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALUMINUM WINDOWS

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
 1. Frame Depth: 3-1/2 inch (89 mm).
 2. Provide factory-glazed units.
 3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
 4. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 5. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 7. Thermal Movement: Design to accommodate thermal movement caused by 180 degrees F (82.2 degrees C) surface temperature without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.
- B. Fixed, Non-Operable Type:
 1. Construction: Thermally broken.
 2. Glazing: Double; gray tinted; transparent.
 3. Exterior Finish: Class I color anodized.
 4. Interior Finish: Class I color anodized.

2.03 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
 1. Performance Class (PC): R.
- B. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.

2.04 COMPONENTS

- A. Frames: 2 inch (____ mm) wide by 3 inch (____ mm) deep profile, of 2 inch (____ mm) thick section; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.
- B. Glazing: See Section 08 80 00.
- C. Sills: extruded aluminum; sloped for positive wash; fit under sash leg to 1/2 inch (12 mm) beyond wall face; one piece full width of opening; jamb angles to terminate sill end.
- D. Fasteners: Stainless steel.
- E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.05 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209/B209M, 5005 alloy, H12 or H14 temper.
- C. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

2.06 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42, integrally colored anodic coating not less than 0.7 mil (0.018 mm) thick.
- B. Pigmented Organic Coatings: AAMA 2603; polyester or acrylic baked enamel finish.
 - 1. Products:
 - a. PPG; Duracron: www.ppgmetalcoatings.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Finish Color: As selected by Construction Manager from manufacturer's standard range.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 07 25 00.

3.02 PRIME WINDOW INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- C. Install windows in accordance with ASTM E2112.
- D. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- E. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- F. Install sill and sill end angles.
- G. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- H. Install glass and infill panels in accordance with requirements; see Section 08 80 00.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 10 ft (3 mm/3 m), whichever is less.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- B. Provide field testing of installed aluminum windows by independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
 - 1. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf (91 Pa).

2. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf (75 Pa).
- C. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 CLEANING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.
- B. Remove protective material from factory finished aluminum surfaces.
- C. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- D. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.
- E. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

END OF SECTION

SECTION 08 62 00 - MODULAR SKYLIGHTS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Skylights with integral frame.

1.02 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022.
- B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2023.
- D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Include structural, thermal, and daylighting performance values.
- C. Shop Drawings: Indicate configurations, dimensions, locations, fastening methods, and installation details.
- D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Evidence of WDMA Certification.
 - 3. Evidence of CSA Certification.
 - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Modular Skylights:
 - 1. Velux America, Inc;VMS ____: www.veluxusa.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SKYLIGHTS

- A. Skylights: Factory-assembled glazing in fiberglass frame, free of visual distortion, and weathertight.
 - 1. Shape: rectangular modular.
 - 2. Glazing: Double.
 - 3. Operation: None; fixed.
 - 4. Roof Slope: As indicated on drawings.
 - 5. Nominal Size: As indicated on drawings.

2.03 PERFORMANCE REQUIREMENTS

- A. Provide modular skylights that comply with the following:
 - 1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific skylight type:
 - a. Performance Grade (PG): Equivalent to or greater than specified design pressure.
 - 2. Allow for expansion and contraction within system components caused by a cycling surface temperature range of 170 degrees F (95 degrees C) without causing detrimental effects to system or components.
 - 3. Energy Code Compliance: Comply with ICC (IBC), ASHRAE Std 90.1 I-P, or the authorities having jurisdiction as required for unit skylights.

2.04 DESIGN CRITERIA

- A. Modular Skylight Design: Design and size components to withstand dead loads and live loads caused by snow, hail, and positive and negative wind loads acting on skylight unit without damage or permanent set.
 - 1. Regulatory Requirements: Comply with applicable code criteria for loads, including seismic loads.
 - 2. Design Loads:
 - a. Roof Live Load: 20 psf (.96 kPa); deflection limited to 1/240 of span.
 - 1) Snow Load: 45 psf (2.15 kPa).

2.05 COMPONENTS

- A. Double Glazing: _____; factory sealed.
 - 1. Outer Glazing: Clear transparent.
 - 2. Inner Glazing: Clear transparent.
 - 3. Ultraviolet (UV) Light Transmission: 2 percent, maximum.
 - 4. Solar Heat Gain Coefficient (SHGC): 23 percent, nominal.

2.06 ACCESSORIES

- A. Anchorage Devices: Type recommended by manufacturer, exposed to view.
- B. Protective Back Coating: Zinc molybdate alkyd.
- C. Sealant: Elastomeric, silicone or polyurethane, compatible with material being sealed .

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that openings and substrate conditions are ready to receive work of this section.

3.02 PREPARATION

- A. Apply protective back coating on aluminum surfaces of skylight units that will be in contact with cementitious materials or dissimilar metals.

3.03 INSTALLATION

- A. Install unit skylights in accordance with manufacturer's instructions and ASTM E2112.
- B. Install skylight units and mount securely to curb assembly; install counterflashing as required.
- C. Apply sealant to achieve watertight assembly.

3.04 CLEANING

- A. Remove protective material from prefinished aluminum surfaces.

SECTION 08 62 00

MODULAR SKYLIGHTS

- B. Wash down exposed surfaces; wipe surfaces clean.
- C. Remove excess sealant.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Hardware for hollow metal doors.
- B. Thresholds.
- C. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. BHMA A156.1 - Standard for Butts and Hinges; 2021.
- C. BHMA A156.2 - Bored and Preassembled Locks and Latches; 2022.
- D. BHMA A156.3 - Exit Devices; 2020.
- E. BHMA A156.4 - Door Closers and Pivots; 2024.
- F. BHMA A156.6 - Standard for Architectural Door Trim; 2021.
- G. BHMA A156.7 - Template Hinge Dimensions; 2022.
- H. BHMA A156.8 - Door Controls - Overhead Stops and Holders; 2021.
- I. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.
- J. BHMA A156.18 - Standard for Materials and Finishes; 2020.
- K. BHMA A156.21 - Thresholds; 2019.
- L. BHMA A156.22 - Standard for Gasketing; 2021.
- M. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.
- N. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
- O. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- Q. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Keying Requirements Meeting:
 - 1. Schedule meeting at project site prior to Contractor occupancy.
 - 2. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - c. Hardware Installer.
 - 3. Agenda:
 - a. Establish keying requirements.
 - 4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - 5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Construction Manager, Owner, participants, and those affected by decisions made.
 - 6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 - 2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
 - 3. List groups and suffixes in proper sequence.
 - 4. Provide complete description for each door listed.
 - 5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
- D. Keying Schedule:
 - 1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
 - 1. Exit Devices: Three years, minimum.
 - 2. Locksets and Cylinders: Three years, minimum.
 - 3. Other Hardware: Two years, minimum.

PART 2 PRODUCTS**2.01 DESIGN AND PERFORMANCE CRITERIA**

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Accessibility: ADA Standards and ICC A117.1.
- D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.
- E. Fasteners:

1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - a. Self-drilling (Tek) type screws are not permitted.
3. Fire-Rated Applications: Comply with NFPA 80.
 - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

- A. Manufacturers:
 1. McKinney; an Assa Abloy Group company; T4A3386 NRP : www.assaabloydss.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Hinges: Comply with BHMA A156.1, Grade 1.
 1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
 - a. Provide hinge width required to clear surrounding trim.
 2. Provide hinges on every swinging door.
 3. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
 4. Provide non-removable pins on exterior outswinging doors.
 5. Provide following quantity of butt hinges for each door:
 - a. Doors From 60 inches (1.5 m) High up to 90 inches (2.3 m) High: Three hinges.

2.03 EXIT DEVICES

- A. Manufacturers:
 1. Corbin Russwin; an Assa Abloy Group company, www.assaabloydss.com/#sle. (RU) - ED4000 / ED5000 Series.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Exit Devices: Comply with BHMA A156.3, Grade 1.
 1. Lever design to match lockset trim.
 2. Provide cylinder with cylinder dogging or locking trim.
 3. Provide exit devices properly sized for door width and height.
 4. Provide strike as recommended by manufacturer for application indicated.
 5. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

6. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.04 CYLINDRICAL LOCKS

- A. Manufacturers:
 1. Corbin Russwin; an Assa Abloy Group company; _____:
www.assaabloydss.com/#sle.
- B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
 1. Bored Hole: 2-1/8 inch (54 mm) diameter.
 2. Latchbolt Throw: 1/2 inch (12.7 mm), minimum.
 3. Backset: 2-3/4 inch (70 mm) unless otherwise indicated.
 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.
 5. Provide a lock for each door, unless otherwise indicated that lock is not required.

2.05 DOOR PULLS AND PUSH PLATES

- A. Door Pulls and Push Plates: Comply with BHMA A156.6.
 1. Pull Type: Straight, unless otherwise indicated.
 2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
 - a. Edges: Beveled, unless otherwise indicated.
 3. Material: Stainless steel, unless otherwise indicated.

2.06 DOOR PULLS AND PUSH BARS

- A. Door Pulls and Push Bars: Comply with BHMA A156.6.
 1. Bar Type: Bar set, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.

2.07 COORDINATORS

- A. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
 1. Type: Bar, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.
 3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.08 CLOSERS

- A. Manufacturers; Surface Mounted:
 1. Corbin Russwin; an Assa Abloy Group company; _____:
www.assaabloydss.com/#sle.
 2. Norton Rixson (NO) - 7500 Series..
- B. Closers: Comply with BHMA A156.4, Grade 1.
 1. Type: Surface mounted to door.
 2. Provide door closer on each exterior door.
 3. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

2.09 OVERHEAD STOPS AND HOLDERS

- A. Manufacturers:

1. Rockwood (RO).
2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
 1. Provide stop for every swinging door, unless otherwise indicated.

2.10 PROTECTION PLATES

- A. Manufacturers:
 1. Rockwood; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Protection Plates: Comply with BHMA A156.6.
- C. Metal Properties: Stainless steel material.
 1. Metal, Standard Duty: Thickness 0.050 inch (1.27 mm), minimum.
- D. Edges: Beveled, on four sides unless otherwise indicated.
- E. Fasteners: Countersunk screw fasteners.

2.11 KICK PLATES

- A. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
 1. Size: 8 inch (203 mm) high by 2 inch (51 mm) less door width (LDW) on push side of door.

2.12 DOOR HOLDERS

- A. Manufacturers:
 1. McKinney or Rockwood; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Door Holders: Comply with BHMA A156.16, Grade 1.
 1. Type: Lever, or kick down stop, with rubber bumper at bottom end.
 2. Material: Steel.

2.13 THRESHOLDS

- A. Manufacturers:
 1. Pemko; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
- B. Thresholds: Comply with BHMA A156.21.
 1. Provide threshold at each exterior door, unless otherwise indicated.
 2. Type: Flat surface.
 3. Material: Aluminum.
 4. Threshold Surface: Fluted horizontal grooves across full width.
 5. Field cut threshold to profile of frame and width of door sill for tight fit.
 6. Provide non-corroding fasteners at exterior locations.

2.14 WEATHERSTRIPPING AND GASKETING

- A. Manufacturers:
 1. Pemko; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
 1. Head and Jamb Type: Adjustable.
 2. Door Sweep Type: Encased in retainer.
 3. Material: Aluminum, with brush weatherstripping.

4. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
5. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.15 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
 1. Primary Finish: 630; satin stainless steel, with stainless steel 300 series base material (former US equivalent US32D); BHMA A156.18.
 2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
 - a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
 1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
 2. Mounting heights in compliance with ADA Standards:
 - a. Locksets: 40-5/16 inch (1024 mm).
 - b. Push Plates/Pull Bars: 42 inch (1067 mm).
 - c. Exit Devices: 40-5/16 inch (1024 mm).
 - d. Door Viewer: 43 inch (1092 mm); standard height 60 inch (1524 mm).
- D. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.02 ADJUSTING

- A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.03 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

3.04 PROTECTION

- A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 08 80 00 - GLAZING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Insulating glass units.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- B. Section 08 51 13 - Aluminum Windows: Glazing provided by window manufacturer.
- C. Section 08 62 00-Modular Skylights: Glazing furnished as part of modular skylights.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- I. GANA (SM) - GANA Sealant Manual; 2008.
- J. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
- K. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.
- L. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Polycarbonate Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

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

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C. Polycarbonate Sheet Glazing: Provide a five (5) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Glass Fabricators:
 - 1. GGI - General Glass International; _____: www.generalglass.com/#sle.
 - 2. Tecnoglass; Insulating Glass: www.tecnoglass.com/#sle.
 - 3. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
 - 4. Viracon, Inc: www.viracon.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Laminated Glass Manufacturers:
 - 1. Cardinal Glass Industries; _____: www.cardinalcorp.com/#sle.
 - 2. Dreamwalls by Gardner Glass Products; Laminated Glass: www.dreamwalls.com/#sle.
 - 3. Tecnoglass; Laminated Glass: www.tecnoglass.com/#sle.
 - 4. Viracon, Architectural Glass segment of Apogee Enterprises, Inc; _____: www.viracon.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Plastic Films Manufacturers:
 - 1. 3M Window Film; _____: solutions.3m.com/wps/portal/3M/en_US/Window_Film/Solutions/#sle.
 - 2. Flexvue Films; _____: www.flexvuefilms.com/#sle.
 - 3. LLumar, an Eastman Chemical Company; LLumar: www.llumar.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 3. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.

1. In conjunction with weather barrier related materials described in other sections, as follows:
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.

2.04 INSULATING GLASS UNITS

- A. Manufacturers:
 1. Cardinal Glass Industries; _____: www.cardinalcorp.com/#sle.
 2. Guardian Glass, LLC; _____: www.guardianglass.com/#sle.
 3. Pilkington North America Inc; _____: www.pilkington.com/na/#sle.Pilkington North America Inc; _____: www.pilkington.com/na/#sle.
 4. Viracon, Apogee Enterprises, Inc; _____: www.viracon.com/#sle.
 5. Vitro Architectural Glass (formerly PPG Glass); _____: www.vitroglazings.com/#sle.
 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
- C. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Spacer Color: Black.
 4. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 - b. Color: Black.
 5. Purge interpane space with dry air, hermetically sealed.
 6. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet (762 m)

between point of fabrication and point of installation to permit pressure equalization of air space.

- a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.
- D. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Clear.
 4. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
 - a. Tint: Clear.
 5. Total Thickness: 1 inch (25.4 mm).
 6. Thermal Transmittance (U-Value), Summer - Center of Glass: 2.8, nominal.
 7. Solar Heat Gain Coefficient (SHGC): .50, nominal.
 8. Glazing Method: Dry glazing method, gasket glazing.

2.05 BASIS OF DESIGN - INSULATING GLASS UNITS

- A. Basis of Design - Insulating Glass Units: Vision glazing, with low-e coating.
 1. Applications: Exterior insulating glass glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Total Thickness: 1 inch (25.4 mm).
 4. Thermal Transmittance (U-Value), Summer - Center of Glass: _____, nominal.
 5. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 6. Spacer Color: Black.
 7. Edge Seal:
 8. Color: Black.
 9. Purge interpane space with dry air, hermetically sealed.
 10. Basis of Design - Guardian Glass, LLC: www.guardianglass.com/#sle.
 11. Outboard Lite: 1/4 inch (6 mm) thick pane, minimum of the type specified below.
 - a. Standard Glass: Heat-strengthened float glass, 1/4 inch (6 mm).
 - 1) Coating:
 - (a) Low-E Coating: SunGuard SN 68 on #2 surface.
 12. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick.
 - a. Low-E Coating: SunGuard SN 68 on #3 surface.

2.06 GLAZING UNITS

- A. Type G-1 - Monolithic Exterior Vision Glazing:
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Glass Type: Annealed float glass.
 3. Tint: Gray.
 4. Thickness: 1/4 inch (6.4 mm), nominal.

2.07 PLASTIC SHEET GLAZING UNITS

- A. Type P-3 - Multiwall Standing Seam Polycarbonate Sheet: Ultraviolet (UV) protected.

1. Applications: Locations as indicated on drawings.
2. Type: Cellular (multiwall structure) sheet.
3. Tint: Clear.
4. Multiwall Thickness: 15/16 inch (23.5 mm) overall, with polycarbonate joiner along both sides.
5. Width: 23-5/8 inch (600 mm).

2.08 GLASS COATINGS

- A. Solar Control Coating: Two-component, metal-oxide nano-particles with 5 percent solids content, minimum.
 1. Application: Locations as indicated on drawings.
 2. Color: Clear, fade resistant.
 3. Dry Film Thickness: 10 microns (0.01 mm), bubble and crack resistant.

2.09 ACCESSORIES

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

2.10 SOURCE QUALITY CONTROL

- A. Provide shop inspection and testing for Type _____ glass.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

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

3.06 PROTECTION

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

END OF SECTION

SECTION 08 91 00 - LOUVERS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Louvers, frames, and accessories.

1.02 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Louvers:
 1. Airline Louvers; _____: www.airlinelouvers.com/#sle.
 2. Airolite Company, LLC; _____: www.airolite.com/#sle.
 3. Construction Specialties, Inc; Acoustical Louver: www.c-sgroup.com/#sle.
 4. Industrial Louvers, Inc; _____: www.industrialouvers.com/#sle.
 5. Ruskin Company; Louvers: www.ruskin.com/#sle.
 6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOUVERS

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

2.03 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), _____ alloy, _____ temper.

2.04 FINISHES

- A. Pigmented Organic Coatings: AAMA 2603; polyester or acrylic baked enamel finish.
- B. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
- C. High Performance Organic Coating: Primer and topcoat coatings system based on polyester resin powder containing high-level of isophthalic acid; with minimum dry film

thickness (DFT) of 2 to 3.5 mil, 0.0020 to 0.0035 inch (0.051 to 0.089 mm) over aluminum extrusions and panels; meeting requirements of AAMA 2604.

2.05 ACCESSORIES

- A. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.
- B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
- C. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.
- D. Insect Screen: 18 x 16 size aluminum mesh.
- E. Fasteners and Anchors: Galvanized steel.
- F. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.
- G. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- D. Secure louver frames in openings with concealed fasteners.

3.03 CLEANING

- A. Strip protective finish coverings.
- B. Clean surfaces and components.

END OF SECTION

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 23 37 00 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- B. Section 26 51 00 - Interior Lighting: Light fixtures in ceiling system.
- C. Section 28 46 00 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components and acoustical units.

1.05 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Suspension Systems:
 - 1. Same as for acoustical units.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
 - 1. Local authorities having jurisdiction.

2.03 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.

- B. Acoustical Panels: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - a. Pattern: "A" - perforated, regularly spaced large holes.
 - 2. Size: 24 by 24 inches (610 by 610 mm).
 - 3. Thickness: 5/8 inches (16 mm).
 - 4. NRC Range: .50 to .90, determined in accordance with ASTM E1264.
 - 5. Panel Edge: Square.
 - 6. Color: White.
 - 7. Suspension System: Exposed grid.
 - 8. Products:
 - a. Armstrong World Industries, Inc; Dune: www.armstrongceilings.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid with cap.
 - 1. Application(s): Seismic.
 - 2. Profile: Tee; 15/16 inch (24 mm) face width.
 - 3. Finish: Baked enamel.
 - 4. Color: White.
 - 5. Products:
 - a. USG Corporation; Donn Brand ZXLA 15/16 inch Acoustical Suspension System: www.usg.com/ceilings/#sle.
 - b. Armstrong World Industries: Prelude XL 15/16" Exposed Tee.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12-gage 0.08 inch (2 mm) galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- E. Perimeter Moldings: Same metal and finish as grid.
 - 1. Size: As required for installation conditions and specified Seismic Design Category.
 - 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- B. Locate system on room axis according to reflected plan.
- C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- D. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- E. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch (19 mm) clearance between grid ends and wall.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
 - 6. Floors, unless specifically indicated.
 - 7. Glass.
 - 8. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, submit each color in each sheen available.
 - 3. Allow 30 days for approval process, after receipt of complete samples by Architect.

1.04 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
- B. Paints:
 - 1. Behr Paint Company: www.behr.com/#sle.
 - 2. Dow: www.dow.com/#sle.
 - 3. Rodda Paint Company: www.roddapaint.com/#sle.
 - 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

- C. Apply each coat to uniform appearance.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.05 SCHEDULE - PAINT SYSTEMS

- A. Shop-Primed Metal Items:
 - 1. Finish the following items:
 - a. Exterior metal doors and frames.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Floors, unless specifically indicated.
 - 7. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
 - 8. Glass.
 - 9. Concrete masonry units in utility, mechanical, and electrical spaces.
 - 10. Acoustical materials, unless specifically indicated.
 - 11. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
- B. Paints:
 - 1. Behr Paint Company: www.behr.com/#sle.
 - 2. Rodda Paint Co: www.roddapaint.com/#sle.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood and metal surfaces lightly between coats to achieve required finish.

- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.06 SCHEDULE - PAINT SYSTEMS

- A. Shop-Primed Metal Items: Finish sur
 - 1. Finish the following items:
 - a. Metal doors and frames.

END OF SECTION

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SECTION 23 01 30.51 – HVAC AIR-DISTRIBUTION SYSTEM CLEANING**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Cleaning of HVAC duct system, equipment, and related components.

1.2 RELATED REQUIREMENTS

- A. All Division 01 sections for – Quality Requirements: Additional requirements for testing and inspection agencies.
- B. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- C. Section 23 08 00 – Commissioning of HVAC.

1.3 DEFINITIONS

- A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.

1.4 REFERENCE STANDARDS

- A. NADCA ACR – The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System.
- B. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors.
- C. UL 181A – Closure Systems for Use with Rigid Air Ducts.

1.5 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC, for submittal procedures.
- B. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.6 QUALITY ASSURANCE

- A. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.
 - 1. Certified by one of the following:
 - a. NADCA, National Air Duct Cleaners Association: www.nadca.com.
 - 2. Having minimum of three years of documented experience.
 - 3. Employing for this project a supervisor certified as an Air Systems Cleaning Specialist by NADCA.

PART 2 – PRODUCTS**2.1 TOOLS AND EQUIPMENT**

- A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.
- B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97% collection efficiency for minimum 0.3-micron size particles and DOP test number.
- C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

PART 3 – EXECUTION**3.1 PROJECT CONDITIONS**

- A. Comply with applicable federal, state, and local requirements.
- B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA “Assessment, Cleaning and Restoration of HVAC Systems” (ACR) and as specified herein.
- C. Where NADCA ACR uses the terms “recommended”, “highly recommended”, or “ideally” in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.
- D. Obtain Construction Manager’s approval of proposed temporary locations for large equipment.
- E. Designate a decontamination area and obtain Construction Manager’s approval.
- F. If unforeseen mold or other biological contamination is encountered, notify Construction Manager immediately, identifying areas affected and extent and type of contamination.

3.2 EXAMINATION

- A. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.
- B. Start of cleaning work constitutes acceptance of existing conditions.
- C. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.
- D. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.3 PREPARATION

- A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.
- B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.
- C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.
- D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
 - 1. Do not cut openings in non-HVAC components without obtaining the prior approval of Construction Manager.
 - 2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
 - 3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.
- E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.4 CLEANING

- A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.
- B. Obtain Construction Manager's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.
- C. Ducts: Mechanically clean all portions of ducts.
- D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.
- E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.
- F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.
- G. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

- H. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.5 REPAIR

- A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.
- B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.
- C. Reseal new openings in accordance with NADCA Standard 05.
- D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.
- E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Construction Manager in project report documents.

3.6 FIELD QUALITY CONTROL

- A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.
- B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.
- C. Coils: Cleaning must restore the coil pressure drop to within 10% of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.
- D. Notify Construction Manager when cleaned components are ready for inspection.
- E. When directed, re-clean components until they pass.
- F. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.7 ADJUSTING

- A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.8 WASTE MANAGEMENT

- A. Double-bag waste and debris in 6 mil, 0.006-inch-thick polyethylene plastic bags.
- B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION 23 01 30.51

SECTION 23 05 00 – COMMON WORK RESULTS FOR HVAC**PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SCOPE OF WORK – GENERAL

- A. This section specifies general requirements for HVAC installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements specified in sections of Division 01.
- B. Provide materials, labor, transportation, tools, permits, fees, inspections, utilities, and incidentals necessary for the complete installation of HVAC work indicated and described in the Contract Documents.
- C. It is the intent of the Contract Documents to provide an installation complete in every respect. If additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, provide material and equipment which is usually furnished with such systems to complete the installation, whether mentioned or not.

1.3 CODES AND STANDARDS

- A. Code Compliance: Comply with most current edition adopted by the Authority Having Jurisdiction of the following:
 - 1. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 2. ASTM E814 – Standard Test Method for Fire Tests of Penetration Firestop Systems.
 - 3. ICC (IBC) – International Building Code.
 - 4. ICC (IFC) – International Fire Code.
 - 5. ICC (IFGC) – International Fuel Gas Code.
 - 6. ICC (IMC) – International Mechanical Code.
 - 7. NFPA 70 – National Electrical Code.
 - 8. Washington State Energy Code, Commercial Provisions.
 - 9. Applicable State and local codes, laws, and ordinances.

1.4 SEQUENCE OF WORK

- A. Conduct work in sequence to provide least interference to the activities of the Construction Manager, and to permit orderly transfer of activities and equipment to completed areas.

1.5 ALTERNATES

- A. Refer to Division 01 Section "Alternates" for description of alternates. Review Contract Documents for additional information.

1.6 DEFINITIONS

- A. Provide: Furnish and install complete and ready for intended use.
- B. Indicated: Indicated on drawings.
- C. Noted: Noted on Drawings or in Specifications.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.7 SAFETY OF PERSONS AND PROPERTY

- A. Comply with applicable laws, ordinances, rules, and regulations of any public authority for the safety of persons and property, including requirements of the Washington Department of Safety and Health (DOSH) or the Occupational Safety and Health Act (OSHA) whichever is most stringent, and Division 01, General and Supplementary Conditions.

1.8 PERMITS AND FEES

- A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

1.9 INTENT AND INTERPRETATION

- A. Drawings and Specifications supplement each other and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

- B. Drawings are partly diagrammatic and do not necessarily show exact the exact location of new piping and existing utilities, unless specifically dimensioned.
- C. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of equipment. They shall not be used for obtaining quantities or linear runs of piping.
- D. Grilles, fixtures, or other pieces of equipment shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.
- E. Location of piping and ductwork shall be checked to determine that it clears openings and structural members; that it may be properly concealed; and that it clears cabinets, lights and equipment having fixed locations.
- F. Mechanical drawings shall serve as working drawings for Division 23 work. Refer to Architectural, Structural, and Electrical drawings for additional detail affecting the installation of work. The Architectural drawings shall take precedence over the Mechanical drawings if any dimensional discrepancies exist.
- G. The approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details regarding location. Exact locations are to be determined by actual measurements at the building. Not all pipe and duct offsets are indicated on the drawings.

1.10 SUBMITTAL OF EQUIPMENT FOR APPROVAL

- A. Refer to Division 01 requirements for submittal definitions, requirements and procedures. Additional requirements are listed below.
- B. Shop drawings, catalog information, and material schedules shall be submitted for approval on materials and equipment prior to ordering.
- C. Submit a single, complete submittal package for products in Division 23. Submittal package shall be organized by specification number. PDFs shall be bookmarked.

1.11 GUARANTEE

- A. Guarantee satisfactory operation of material and equipment installed under Division 23. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from the date of Substantial Completion.

PART 2 – PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Where more than one manufacturer is listed, provide products of only one manufacturer for each type of product.
- B. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated “new” equipment is not acceptable.

- C. 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.

2.2 EQUIPMENT AND MATERIAL SUBSTITUTIONS

- A. Throughout these Contract Documents, various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type, or catalog number. Such designation is to establish standards of desired quality and construction, and shall be the basis of the bid.
- B. Where more than one manufacturer is listed, and only one manufacturer's catalog number is indicated, that standard of quality and construction shall be maintained by materials supplied by other manufacturer(s).
- C. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Division 01 Section, "Substitution Procedures" for procedures in requesting substitutions. The Construction Manager or Construction Manager's Representative shall review all substitution requests for final approval.
- D. Acceptance of substitution request signifies manufacturer recognition only. No attempt has been made to check each item as to special features, capacities, or physical dimensions required by this project. Verify requirements before submitting for approval. Acceptance of exact features, sizes, capacities, etc., all of which must meet or exceed design requirements will be determined when submitted during the construction phase.
- E. Substitution request must include manufacturer, specific model number, special features, physical dimensions, and capacities of proposed equipment. Verify requirements before submitting for approval.
- F. The Contractor shall bear full responsibility for substituted equipment and materials, including, but not limited to:
 - 1. Costs.
 - 2. Available space requirements
 - 3. Effect on other trades
 - 4. Changes in electrical requirements
 - 5. Changes in structural requirements.

PART 3 – EXECUTION

3.1 COMMISSIONING

- A. At a minimum, comply with the requirements of the Washington State Energy Code.
- B. Refer to Division 01 for additional requirements.

3.2 COORDINATION

- A. Refer to Division 01
- B. Coordinate available space for equipment and systems with other trades. Refer to Architectural, Structural and Electrical Drawings for additional building details necessary for coordination.
- C. Cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between the work of the various trades will be at no additional cost to the Construction Manager.

3.3 MANUFACTURER'S INSTRUCTIONS

- A. Furnish proper equipment and/or materials required for installation as intended by the manufacturer, for all work described under Division 23. If needed for proper installation or operation, request advice and supervisory assistance from the representative of the specific manufacturer. Manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. Promptly notify the Construction Manager in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and obtain the Construction Manager's instructions before proceeding with the work.

3.4 EXAMINATION OF SITE

- A. Visit site of proposed work and become familiar with conditions affecting work. Verify measurements at the building before beginning work.

3.5 EXISTING UTILITIES AND PIPING

- A. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. Assume that such connection points are within a 10-foot radius of indicated locations. Where connection points are not within this radius, contact the Construction Manager for a decision before proceeding.

3.6 LAYING OUT WORK

- A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined from the Construction Drawings. Verify physical dimensions of each item of mechanical equipment, ductwork system and piping system, to fit available space and promptly notify the Construction Manager prior to roughing-in if conflicts appear. Coordinate equipment to available space and access routes through construction. Offsets or transitions in ductwork or piping systems required for proper system operation and/or installation, whether indicated on drawings or not, shall be provided at no additional cost to Construction Manager.

3.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct

identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

- B. Store equipment and materials at the site, unless offsite storage is authorized in writing. Protect stored equipment and materials from damage.
- C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.8 ACCESSIBILITY

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate location of concealed equipment and devices requiring access with location of access panels and doors. Allow ample space for removal of parts that require replacement or servicing.

3.9 TEMPORARY USE OF NEW EQUIPMENT

- A. New equipment shall not be used for temporary heating, cooling, or ventilation unless authorized in writing by the Construction Manager.

3.10 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-½ inch angle set in silicon adhesive around opening.
 - 4. Drilled Penetrations: Provide 1½ inch angle ring or square set in silicone adhesive around penetration.
- B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- C. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc-coated or cast-iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
 - 1. Brass pipe.
 - 2. Connect sleeve with floor plate.
- E. Not required for wall hydrants for fire department connections or in drywall construction.
- F. Clearances:
 - 1. Provide allowance for insulated piping.

2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Division 07.

3.11 CUTTING AND PATCHING

- A. Comply with Division 01 Section, "Execution" for general requirements for cutting and patching.
- B. Cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.
- C. Patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- D. Arrange for repairs required to restore other work, which was damaged caused damage as a result of because of mechanical installations. Upon receipt of written authorization from Construction Manager, Contractor will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 1. Uncover work to provide for installation of ill-timed work.
 2. Remove and replace defective work.
 3. Remove and replace work not conforming to requirements of the Contract Documents.
 4. Remove samples of installed work as specified for testing.
 5. Install equipment and materials in existing structures.
 6. Upon written instructions from the Construction Manager, uncover and restore work to provide for observation of concealed work.
- G. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, and other mechanical items made obsolete by new work.
- H. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

END OF SECTION 23 05 00

SECTION 23 05 05 – PROJECT CLOSEOUT FOR HVAC**PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SCOPE OF WORK – GENERAL

- A. This section specifies procedural requirements for HVAC installations project closeout, including but not limited to:
 - 1. Project Record Document submittal.
 - 2. Operation and Maintenance (O&M) Manual submittal.
 - 3. Operation and Maintenance Instruction and Training.
 - 4. HVAC Equipment and Systems Startup.
 - 5. Final Cleaning.
 - 6. Construction Manager Training Session Agenda.
- B. Related Sections include the following:
 - 1. Division 01 Section, “Submittal Procedures”.
 - 2. Division 01 Section “Closeout Procedures”.

1.3 PROJECT RECORD DOCUMENTS

- A. Record the differences between the HVAC work as installed and as shown in the Contract Drawings on a set of prints of HVAC drawings furnished by Construction Management/ General Contractor. Return these prints to the Construction Management/ General Contractor at the completion of project. Notations made on drawings shall be neat and legible. Comply with Division 01 requirements.
- B. Mark drawings to indicate revisions to HVAC piping and ductwork, size and location both exterior and interior; including locations of coils, dampers, and other control devices, filters, motors and similar items requiring periodic maintenance; actual equipment locations; concealed equipment and control devices; mains and branches of piping systems, with valves and control devices located and numbered.
- C. Revise the equipment and fixture schedules on the Drawings to indicate actual installed manufacturer and model numbers.
- D. Mark specifications to indicate change orders; actual equipment and materials used.

1.4 OPERATION AND MAINTENANCE MANUALS

- A. Prepare and submit Operation and Maintenance (O&M) Manuals for HVAC systems provided. Comply with Division 01 requirements.

- B. Provide primary index at beginning of Manual showing sections and items included.
- C. Cover section: List name, address, and phone number of Construction Manager, Project Architect, General Contractor, Mechanical Engineer, Electrical Engineers, Structural Engineer, HVAC Contractor and all HVAC Subcontractors. Provide a list of equipment suppliers with address and phone number.
- D. Provide a separate section for each Section of the Specifications. Provide an index for each section listing equipment included. Include all specified items.
- E. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
- F. One (1) draft copy of the manual shall be submitted for review, comment, and approval, as applicable, at least 15 days prior to substantial completion or training, whichever is first. After approval, submit one (1) PDF copy of the manual to the Construction Management/ General Contractor for approval unless otherwise directed by Division 01 Section requirements. Information to be included in manual:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 2. Manufacturer's printed operating procedures to include startup, break-in, routine and normal operating instructions; regulation, control, stopping shutdown, and emergency instructions; and summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions and lubrication charts and schedules.
 - 5. Schematic control diagrams for each automatic control system. Mark the correct operating setting for each control instrument on these diagrams.
 - 6. Testing, Adjusting, and Balancing Report.
 - 7. Test records and certifications.
 - 8. Equipment startup reports.
 - 9. Warranty information and letters of guarantee.
 - 10. Instruction period checklist for each equipment item.
- G. Complete O&M Manual shall be available for use by Construction Manager's representatives during instruction and training sessions.

1.5 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

- A. Instruct Construction Manager's Representative(s) in the Operation and Maintenance procedures described in Operation and Maintenance Manual. Comply with Division 01 Section requirements.
- B. Enlist the services of qualified personnel, including each sub-trade and factory trained specialists for each major piece of equipment, to attend training sessions and provide operation and maintenance instructions.
- C. Submit training agenda, schedule and list of representatives for review 30 days prior to training sessions. Confirm attendance by written notification to all participants.
- D. Prepare a checklist of all equipment and systems requiring instruction and maintenance for verification and agreement by the Construction Manager's Representative of satisfactory startup and instruction. The checklist shall include a statement of completion by the Contractor, date and topic(s) covered in each training session, and an attendance list of all participants at each training session. Submit a copy of checklist for review 30 days prior to training sessions. Include copy of the completed checklist in Operation and Maintenance Manual.
- E. Refer to individual Division 23 Sections for additional instruction/training requirements.
- F. All HVAC systems shall be properly functioning prior to instruction period.

PART 2 – PRODUCTS (NOT USED)**PART 3 – EXECUTION****3.1 HVAC EQUIPMENT AND SYSTEMS STARTUP**

- A. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service and demonstrate and train Construction Manager's maintenance personnel.
- B. Include certification of factory-authorized representative status as part of equipment submittal from manufacturer. Include copies of any installation and startup instructions, manufacturer's checklists, and other forms used in startup as part of the equipment submittal.
- C. Include written startup reports with test data for equipment in Operation and Maintenance Manual.
- D. All construction debris, including electrical wiring debris shall be removed from units prior to equipment startup. Areas surrounding and served by equipment being started must be free of construction debris, sheetrock dust, and any materials that may adversely affect the equipment.

3.2 FINAL CLEANING

- A. Refer to Division 01 general requirements for final cleaning.

- B. At time of final cleanup, clean all fixtures and equipment, and leave in condition for use intended. Vacuum cabinet interiors of control panels, air handling units, etc. to remove all construction debris including electrical wiring debris.

END OF SECTION 23 05 05

SECTION 23 05 07 – HVAC DEMOLITION**PART 1 – GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to work of this section.

1.2 SUMMARY

- A. Include all labor, equipment, and materials necessary to complete demolition of existing HVAC systems as shown on the drawings and described herein.
- B. Mechanical Services to areas occupied by Owner shall be maintained.
- C. Related Sections include the following:
 - 1. Division 01 Section, “Summary” for phasing requirements.
 - 2. Division 02 Section, “Selective Demolition” for general demolition requirements and procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them offsite unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

PART 2 – SALVAGE

2.1 MATERIALS OWNERSHIP

- A. The Owner shall have first salvage rights to all removed fixtures and equipment. Coordinate selection with the Owner's Representative.
- B. Except for items or materials to be reused, salvaged, reinstalled or otherwise indicated to remain owner's property, demolished materials shall become Contractor's property and removed from Project site.
- C. Transport and legally dispose of offsite, all materials resulting from demolition not being salvaged.

PART 3 – EXECUTION**3.1 DEMOLITION**

- A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.
- B. Partial Removal: Items of salvageable value to Contractor indicated to be removed, may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.
- C. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
- D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.
- E. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service and protect against damage during demolition operations.
- F. Cut and/or patch and repair all existing floor or wall penetrations not being re-used. Comply with Division 01 Section requirements.
- G. Not all piping, ductwork or equipment items are shown on drawings. Other demolition may be required.
- H. Any existing ductwork or piping that is to be reused or left in existing position shall have the opening of such covered and protected during demolition and construction until final connections can be made.
- I. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment removal shall include removal of all connecting piping, ductwork, etc., either to a point below floor behind wall surface, etc.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

- 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- J. If pipe, insulation, or equipment to remain is damaged in appearance during construction, or is rendered unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

END OF SECTION 23 05 07

SECTION 23 05 17 – SLEEVES AND SLEEVE SEALS FOR HVAC PIPING**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Pipe sleeves.
- B. Pipe-sleeve seals.

1.2 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

PART 2 – PRODUCTS

2.1 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.

2.2 PIPE-SLEEVE SEALS

- A. Manufacturers:
 - 1. Flexicraft Industries.
 - 2. GPT a division of EnPro Industries.
- B. Modular Mechanical Sleeve-Seal:
 - 1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
 - 2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
 - 3. Size and select seal component materials in accordance with service requirements.
 - 4. Glass-reinforced plastic pressure end plates.
- C. Wall Sleeve: PVC material with waterstop collar, and nailer endcaps.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.

- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- E. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 - 3. Locate piping in center of sleeve or penetration.
 - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 - 5. Tighten bolting for a watertight seal.
 - 6. Install in accordance with manufacturer's recommendations.
- F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION 23 05 17

SECTION 23 05 43 – VIBRATION AND SEISMIC CONTROLS FOR HVAC**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Vibration isolation requirements.
- B. Support bases.
- C. Hangers.
- D. Isolation pads.
- E. Flexible duct connectors.
- F. Flexible pipe connectors.

1.2 REFERENCE STANDARDS

- A. ASCE 7-16 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- B. ASHRAE (HVACA) – ASHRAE Handbook – HVAC Applications.
- C. ICC (IBC)-2021 – International Building Code.

1.3 PERFORMANCE REQUIREMENTS

- A. Equipment Seismic Restraints shall be designed in accordance with Chapter 16 of the ICC (IBC)-2021 International Building Code.
- B. Design seismic loads shall be as indicated on Structural drawings.
- C. Selection and installation of seismic restraint devices shall be in accordance with IBC Section 1613 and ASCE (American Society of Civil Engineers) Standard ASCE 7-16.

1.4 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
- C. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including

analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include base weights, equipment static loads, and cantilever loads.
3. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- D. Qualification Data: For Professional Engineer.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

PART 2 – PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA) where not in conflict with other specified requirements:
- C. General Requirements:
 1. Select vibration isolators to provide required static deflection.
 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
 3. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

- D. Each piece of rotating equipment must meet a reasonable criterion for maximum vibration levels at each bearing, while in operation. The criteria for varying operating speeds are given as follows:
1. Peak vibration velocities shall not exceed 0.06 in./sec. If it is discovered that the operating vibration velocities exceed this criterion, the equipment shall be repaired or replaced at no expense to the Owner.

2.2 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide products indicated in this Section or comparable products of one of the following:
1. Mason Industries, Inc.
 2. Amber Booth Co.
 3. Kinetics Noise Control, Inc.
 4. Vibration Eliminator Co., Inc.
 5. Vibration Mountings & Controls, Inc.

2.3 SUPPORT BASES

- A. B-1 Hanger Rods
1. Base shall consist of four (4) vertical steel hanger rods attached to structure above. Hanger rods shall be sufficient to carry a five (5) times overload without yielding or failure. Unless otherwise specified, hangers H-1 shall be located on all four hanger rods in series with the supported load. Rods shall attach to fan at the support "ears" provided. The fan manufacturer shall supply the fan with these "ears" attached.
 - a. Coordination of the location of the ears and the method of attachment is the responsibility of the vibration isolator manufacturer or its representative.
 2. Steel cross-bracing rods shall be provided to base framework above, where vertical hangers are longer than 12 inches to prevent excess motion during startup and operation. Cross-bracing requires isolators if vertical hanger isolators or thrust restraint isolators are mechanically short circuited. Cross-bracing rods should be threaded to allow adjustment of tension at one end.

2.4 HANGERS

- A. H-1 Resilient Hanger
1. Hangers shall consist of a neoprene-in-shear or fiberglass isolator encased in a welded steel bracket. Hangers shall have an operating static deflection of 0.35 inches.
 2. Schedule H-1: Mason HD.

- B. H-2 Spring Hanger
 - 1. Hangers shall consist of a combination of a steel spring and a fiberglass or neoprene isolator placed in series and encased in a welded steel bracket. Hangers shall have minimum operating static deflections as tabulated in the isolation schedule.
 - 2. The hanger shall be designed to carry a five (5) times overload without failure and shall allow up to fifteen (15)° of rod misalignment without metal-to-metal contact or other short circuit.
 - 3. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.
 - 4. Schedule H-2: Mason 30N.

2.5 ISOLATION PADS

- A. IP-1 Isolation Pad
 - 1. Neoprene and cork sandwich pads shall consist of two (2) layers of ¼ inch thick neoprene, sandwiching a layer of cork ¼ inches thick. Pads shall be sized to limit surface pressure to 45 psi.
 - 2. Schedule IP-1: Mason Industries Super KH.

2.6 FLEXIBLE DUCT CONNECTORS

- A. Acceptable Manufacturers:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Corporation
 - 3. Lambro Industries, Inc.
 - 4. Ventfabrics
- B. F-1 Flexible Duct Connectors: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz. per sq. yd.
 - 2. Net Fabric Width: Approximately 2 inches wide.
 - 3. Metal: 3 inches wide, 24 gauge, 0.0239-inch-thick galvanized steel.

2.7 FLEXIBLE PIPE CONNECTORS

- A. Basis of Design Product: Subject to compliance with requirements, provide products indicated in this Section or comparable products of one of the following:
 - 1. Flex-Hose Company, Inc.
 - 2. IMI Flow Design
 - 3. Griswold
 - 4. Hays Fluid Controls

5. Hyspan
- B. P-1 Flexible Hose
1. Flexible hoses shall have an inner tube of EPDM with a stainless-steel braided cover and brass swivel fittings on both ends. Hoses shall be 400 psig working pressure rated, with a minimum burst pressure rating of 1600 psig. Flexible hoses for return air rated plenum applications shall have a fire rating not to exceed: flame spread, 25; smoke density, 50; fuel contribution, 0.
- C. P-2 Stainless Steel Hose
1. Flexible connectors shall be manufactured of corrugated stainless steel hose with braided, flexible stainless-steel cover. The rated working pressure of the braided metal hose shall have a minimum 4:1 safety factor based on an operating temperature of 70°F. Connectors 2-inches in diameter and smaller shall have male nipple fittings. Connectors 2-inches in diameter and larger shall have fixed steel flanges.
 2. Schedule P-2: Flex-Hose “PumpSaver” Series.
- D. P-3 Spherical Pipe Connectors
1. Flexible spherical expansion joints (connectors) shall employ peroxide cured EPDM rubber in the covers, liners, and Dacron tire cord frictioning. Curing shall take place in steel molds closed within heated hydraulic presses. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead is not acceptable. Sizes 2 inches and larger shall have two spheres reinforced with a ductile iron external ring between spheres complete with split ductile iron or steel flanges with hooked or similar devices. Sizes ¾ inch to 1½ inches may have threaded, one-piece bolted flange assemblies, one sphere and cable retention.
 2. The rated design pressure of the molded body shall have a minimum 3:1 safety factor (burst to operating pressure) based on an operating temperature of 70°F. Concentric reducers to the above ratings may be substituted for equal ended expansion joints. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. If control rods are used, they must have ½-inch-thick neoprene washer bushings large enough in diameter to take the thrust at 1000 psi maximum of washer area. All expansion joints shall be installed on the equipment side of the shutoff valves.
 3. Schedule P-3: Flex-Hose “FlexZorber” Series.

PART 3 – EXECUTION**3.1 GENERAL**

- A. Install in accordance with manufacturer's written instructions. Vibration isolators must not cause any change in position of equipment or piping, resulting in piping stresses or misalignment.
- B. Isolate mechanical equipment from the building structure by means of vibration isolators as scheduled herein or on the drawings.
- C. Do not make rigid connections between equipment and building structure that degrades the vibration isolation system specified herein.
- D. Coordinate piping supports with equipment supports to maintain uniformly efficient isolation, expansion and contraction, without creating excessive stresses at any equipment connection or in any portion of the piping.

3.2 DUCTWORK ISOLATION

- A. Isolate all ductwork penetrations through mechanical room(s) walls, ceiling, or floor, as described below:
 - 1. Provide a sheet metal (18 gauge) sleeve to cover the entire perimeter of an oversized wall cut, 1 to 2 inches on each side.
 - 2. Plaster sleeve to the wall or ceiling, and grout to floor, to ensure an airtight seal.
 - 3. Where ductwork penetrated double walls, use a separate sleeve on each side of the wall (allow no sleeve connection between walls).
 - 4. Pack the gap between the penetrating duct and sleeve with fiber insulation and seal airtight with an outer layer or resilient sealant.
 - 5. Penetrations of GWB ceilings by ductwork require only sealing airtight with a resilient acoustical sealant.
 - 6. Packing fiber insulation to be equivalent of the following products:
 - a. Owens Corning Fiberglass
 - b. USG Thermafiber
 - 7. Resilient sealant to be equivalent of the following products:
 - a. USG Acoustical Sealant
 - b. Dow Corning "RTV" silicone Type 2001 two-component elastomeric foam.
 - 8. Use the above penetration treatment regardless of the existence of external duct insulation. Size penetration large enough to pack additional USG Thermafiber and/or sealant between the duct external insulation and the sheet metal sleeve.
- B. Isolate duct penetration through fire rated walls as described below:

1. Support the fire damper on both sides of the wall opening. Support duct independent of fire damper.

3.3 PIPING ISOLATION

- A. Isolate all pipework penetrations through mechanical room(s), walls, ceiling, or floor, as described under DUCTWORK ISOLATION.

3.4 ELECTRICAL CONDUIT ISOLATION

- A. Use flexible electrical conduit to isolate all electrical connections to vibration isolated equipment.
- B. Do not install conduit clamps or hangers between the flex conduit and equipment.
- C. Size flex conduit large enough to allow a non-stressed loop, unrestrained in all directions.
- D. Recommended minimum flex conduit length is 6 feet.

3.5 EQUIPMENT ISOLATORS

- A. Mount vibration isolating devices on concrete base Type B-2.
- B. Support each fan and motor assembly on a single structural steel frame. Provide flexible duct connections Type F-1 at inlet and discharge of fans and air handling units.
- C. Additional Requirements:
 1. Provide brackets to accommodate the isolator. Manufacturer to specify the vertical position and size of the bracket.
 2. Maintain a minimum operating clearance between the equipment frame on rigid steel base frame and the housekeeping pad of 1-inch. Maintain a minimum operating clearance between concrete inertia base and housekeeping pad or floor of 2-inches.
 3. Temporarily support the structural steel or concrete inertia base with blocks or shims, as appropriate, prior to the installation of the machine or isolators.
 4. Install the isolators without raising the machine and frame assembly.
 5. Adjust the isolator after the entire installation is complete and under full operational load so that the load is transferred from the blocks to the isolator. When all isolators are properly adjusted, the blocks or shims will be barely free and shall be removed.
 6. Verify that all insulated isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit equipment startup lateral motion to 2-inches.
 7. Prior to startup, clean out all foreign matter between base and equipment. Verify that there are no isolation short circuits in the base or isolators.

3.6 MISCELLANEOUS

- A. The Contractor shall coordinate with the Structural Engineer to ensure mounting attachment points for seismic restrained springs and seismic snubbers called out in the equipment isolation schedule, will withstand forces generated from the maximum acceleration rating of the restrained springs and snubbers.
- B. All equipment, ductwork, or piping within mechanical rooms or areas, not isolated via spring isolators, given above, shall be separated from contact with the structure via Isolation Pad Type IP-1, plus isolated washers, and bushings, if equipment is bolted to structure.
- C. No machinery, piping, or ductwork shall contact the floor directly, without an Isolation Pad Type IP-1. Size pads to create maximum surface pressure of 45 psi. "Equipment" in this case, includes floor supported ductwork.
- D. Bases specified in the schedule can be supplied by the manufacturer of the equipment if they meet the specifications given herein.

PART 4 – SCHEDULES

4.1 VIBRATION ISOLATION SCHEDULE

EQUIPMENT	MOUNTING	ISOLATOR	STATIC DEFLECTION (INCHES)	BASE	SEISMIC SNUBBERS	FLEX CONNECTOR
Condensing Unit						
ERV Units	Hung	H-1	0.35	B-1	N/A	F-1
Fan Coils	Hung	H-1	0.35	B-1	N/A	F-1
Mechanical Room Ducts		H-1	0.35	B-1	N/A	
Mechanical Room Piping		H-1	0.35	B-1	N/A	

END OF SECTION 23 05 43

SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.

1.2 RELATED REQUIREMENTS

- A. Section 23 08 00 – Commissioning of HVAC.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. AABC (NSTSB) – AABC National Standards for Total System Balance, 7th Edition.
 - 2. ASHRAE Std 111 – Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.
 - 3. NEBB (TAB) – Procedural Standard for Testing Adjusting and Balancing of Environmental Systems.
 - 4. SMACNA (TAB) – HVAC Systems Testing, Adjusting and Balancing.
 - 5. Washington State Energy Code Commercial Provisions, latest adopted version.

1.4 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Identification and types of measurement instruments to be used and their most recent calibration date.

- d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - e. Final test report forms to be used.
 - f. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Construction Manager and for inclusion in operating and maintenance manuals.
 - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 5. Units of Measure: Report data in I-P (inch-pound) units only.

PART 2 – PRODUCTS – NOT USED**PART 3 – EXECUTION****3.1 GENERAL REQUIREMENTS**

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Provide testing, adjusting, and balancing reports for existing equipment to be maintained.
- D. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section independent of the installing contractors or equipment suppliers for this project.
 - 2. Having minimum of five years' documented experience of projects of similar scope and complexity.

3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute.
- E. TAB Supervisor's and Technician's Qualifications: Certified by same organization as TAB agency.
- F. Pre-Qualified TAB Agencies:
 1. Neudorfer Engineers.
 2. AirTest Inc.
 3. United Test & Balance.
 4. TAC Systems.
 5. Hardin and Sons.
 6. Or approved equal.

3.2 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 1. Systems are started and operating in a safe and normal condition.
 2. Temperature control systems are installed complete and operable.
 3. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 4. Duct systems are clean of debris.
 5. Fans are rotating correctly.
 6. Air coil fins are cleaned and combed.
 7. Access doors are closed and duct end caps are in place.
 8. Air outlets are installed and connected.

3.3 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within $\pm 5\%$ of design for supply systems and $\pm 10\%$ of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10% and minus 5% of design to space. Adjust outlets and inlets in space to within $\pm 10\%$ of design.

3.4 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 - 1. Running log of events and issues.
 - 2. Discrepancies, deficient or uncompleted work by others.
 - 3. Contract interpretation requests.
 - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50% loading of filters.
- E. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- F. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- G. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

3.6 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Air Coils.
 - 2. Air Filters.
 - 3. Air Inlets and Outlets.

4. Energy Recovery Ventilators.
5. Exhaust Fans.

3.7 MINIMUM DATA TO BE REPORTED**A. Electric Motors:**

1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Sheave Make/Size/Bore.

B. Dedicated Outside Air Supply Unit (DOAS)

1. Identification/location.
2. Manufacture.
3. Model number.
4. Serial number.
5. Design outside air flow.
6. Actual outside air flow.
7. Design return air flow.
8. Actual return air flow
9. Design supply air flow.
10. Actual supply air flow.
11. Design exhaust air flow.
12. Actual exhaust air flow.
13. Filter pressure drop design/actual
14. Supply fan RPM
15. Exhuast fan RPM

C. Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.

5. Air flow, specified and actual.
 6. Total static pressure (total external), specified and actual.
 7. Inlet pressure.
 8. Discharge pressure.
 9. Fan RPM.
- D. Duct Traverses:
1. System zone/branch.
 2. Duct size.
 3. Area.
 4. Design velocity.
 5. Design air flow.
 6. Test velocity.
 7. Test air flow.
 8. Duct static pressure.
 9. Air temperature.
- E. Electric Heating Coils for All Stages
- a. Design Data and Recorded Data
 - 1) Kilowatts.
 - 2) MBH.
 - 3) Voltage, phase, amperage (simultaneously with air temperatures).
 - 4) Cubic feet per minute.
 - 5) Entering and leaving air temperature (simultaneously with amperage).
 - 6) Air pressure drop.
 - b. Identification Data
 - 1) System served.
 - 2) Coil location.
- F. DX Cooling Coils
- a. Design Data and Recorded Data for All Stages
 - 1) MBH.
 - 2) Entering and leaving air temperature.
 - 3) Cubic feet per minute.

- b. Identification Data
 - 1) Air pressure drop (for all units with factory-installed pressure ports).
 - 2) System served.
 - 3) Coil location.

- G. Fan-Powered Terminal
 - a. Design Data and Recorded Data.
 - b. Identification Data
 - 1) Manufacturer's Identification.
 - 2) Size.
 - 3) Primary Maximum Airflow.
 - 4) Primary Minimum Airflow.
 - 5) Fan Airflow.

- H. Cabinet Heaters
 - a. Design Data and Recorded Data
 - 1) MBH.
 - 2) Gallons per minute.
 - 3) Entering and leaving water temperature.
 - 4) Entering and leaving air temperature.
 - 5) Cubic feet per minute.
 - 6) Water pressure drop.
 - 7) Air velocity.

END OF SECTION 23 05 93

SECTION 23 07 13 – DUCT INSULATION**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Duct insulation.
- B. Duct liner.
- C. Jacketing and accessories.

1.2 REFERENCE STANDARDS

- A. ASTM B209/B209M – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- C. ASTM C534/C534M – Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- D. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- E. ASTM C916 – Standard Specification for Adhesives for Duct Thermal Insulation.
- F. ASTM C1071 – Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- G. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. ASTM E96/E96M – Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- I. SMACNA (DCS) – HVAC Duct Construction Standards Metal and Flexible.
- J. The publications listed above form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.

1.3 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 – PRODUCTS**2.1 REGULATORY REQUIREMENTS**

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
1. CertainTeed Corporation.
 2. Johns Manville.
 3. Knauf Insulation.
 4. Owens Corning Corporation.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
1. K value: 0.36 at 75°F, when tested in accordance with ASTM C518.
- C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 3. Secure with pressure-sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.3 GLASS FIBER, RIGID

- A. Manufacturer:
1. CertainTeed Corporation.
 2. Johns Manville.
 3. Knauf Insulation.
 4. Owens Corning Corporation.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. K Value: 0.24 at 75°F, when tested in accordance with ASTM C518.
 2. Maximum Density: 8.0 pcf.
- C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

3. Secure with pressure-sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.
- 2.4 FLEXIBLE ELASTOMERIC CELLULAR INSULATION
- A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534MASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40°F.
 2. Maximum Service Temperature: 180°F.
 3. Connection: Waterproof vapor barrier adhesive.
- B. Insulation with Cladding: Flexible elastomeric cellular rubber insulation with laminated covering.
1. White embossed 17.5 mils laminated metal cladding.
 2. Zero permeability, UV resistant, puncture resistant cladding.
 3. Suitable for exterior use.
 4. Sheet form, with or without pressure sensitive adhesive.
- 2.5 JACKETING AND ACCESSORIES
- A. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
 2. Thickness: 0.016 inch sheet.
 3. Finish: Embossed.
 4. Joining: Longitudinal slip joints and 2 inch laps.
 5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
 6. Metal Jacket Bands: $\frac{3}{8}$ inch wide; 0.015 inch thick aluminum.
- 2.6 DUCT LINER
- A. Manufacturers:
1. CertainTeed Corporation.
 2. Johns Manville.
 3. Owens Corning Corporation.
- B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board;

impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.

1. Fungal Resistance: No growth when tested according to ASTM G21.
 2. Apparent Thermal Conductivity: Maximum of 0.31 at 75°F.
 3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
- C. Adhesive: Waterproof, fire-retardant type, ASTM C916.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Complete ductwork testing prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. External Duct Insulation Application:
 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 2. Install without sagging on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- D. Duct Liner Application:
 1. Adhere insulation with adhesive for 90% coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.3 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated or scheduled, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed 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 Division 7 Section "Through-Penetration Firestop Systems".

3.4 APPLICATION REQUIREMENTS:

- A. Regulatory Requirements:
 - 1. Provide installed insulation R-values in accordance with the requirements of [2021 Washington] State Energy Code but not less than specified herein.
- B. Definitions:
 - 1. Conditioned Space: Enclosed within the building thermal envelope.
 - 2. Unconditioned Space: Not within the building thermal envelope.
 - 3. Outside Air: Ambient air from outside the building thermal envelope.
 - 4. Supply Air: Conditioned air delivered to any space.
 - 5. Return Air: Air removed from any space and conveyed to air-handling unit or to energy recovery media.
 - 6. Relief Air: Room air conveyed to the exterior.
 - 7. Exhaust Air: Air removed from any space and conveyed to exterior or discharge air from energy recovery media to exterior.
- C. Duct Location and Use (Line number corresponds to Use Type number in table below.)
 - 1. Outside air ductwork inside conditioned space and upstream of automatic shutoff damper. Airflow greater than or equal to 2800 CFM.
 - 2. Outside air ductwork inside conditioned space and downstream of automatic shutoff damper to HVAC unit or room.
 - 3. Outside air ductwork inside conditioned space. Airflow less than 2800 CFM.
 - 4. Supply air and return air ductwork outside building thermal envelope, exposed to weather, including attics above insulated ceilings, parking garages, and crawl spaces.
 - 5. Supply air and return air ductwork inside unconditioned space, enclosed but outside of building thermal envelope.

6. Supply air and return air ductwork inside unconditioned space where the duct conveys air that is within 15°F of the surrounding unconditioned space.
7. Supply and return air ductwork within a building envelope assembly.
8. Supply air ductwork within conditioned space where the duct conveys air that is less than 55°F or greater than 105°F.
9. Supply air ductwork within the conditioned space that the duct directly serves.
10. Supply air ductwork within the conditioned space where the duct conveys air that is 55°F or greater and 105°F or less.
11. Return air or exhaust air ductwork with the conditioned space, downstream of energy recovery media, upstream of automatic shutoff damper.
12. Relief or exhaust air ductwork within conditioned space and downstream of automatic shutoff damper.

3.5 DUCT INSULATION SCHEDULE

DUCT SYSTEM	USE TYPE	CLIMATE ZONE	INSTALLED R-VALUE	NOTES
OUTDOOR AIR	1	4C	R-16	
	2	4C	R-8	
	3	4C	R-7	
SUPPLY AIR OR RETURN AIR	4	4C	R-8	WEATHER RESISTANT JACKETING
	5	4C	R-6	
	6	4C	R-3.3	
	7	4C	R-16	
SUPPLY AIR	8	4C	R-3.3	
	9	4C	NONE	
	10	4C	NONE	
RETURN OR EXHAUST AIR	11	4C	R-8	
RELIEF OR EXHAUST AIR	12	4C	R-16	

END OF SECTION 23 07 13

SECTION 23 07 19 – HVAC PIPING INSULATION**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Fitting covers.

1.2 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 2. ASTM C534/C534M – Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 3. ASTM C547 – Standard Specification for Mineral Fiber Pipe Insulation.
 - 4. ASTM C795 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - 5. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 6. ASTM E96/E96M – Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
 - 7. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

PART 2 – PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, RIGID

- A. Manufacturers:
 - 1. CertainTeed Corporation
 - 2. Johns Manville Corporation
 - 3. Knauf Insulation.
 - 4. Owens Corning Corporation.
 - 5. Substitutions: See Division 01.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75°F.
 - 2. Maximum Service Temperature: 850°F.
 - 3. Maximum Moisture Absorption: 0.2% by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: -40°F.
 - 2. Maximum Service Temperature: 180°F.
 - 3. Connection: Waterproof vapor barrier adhesive.
- B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 FITTING COVERS

- A. Manufacturers:
 - 1. Johns Manville Corporation "Zeston"
 - 2. P.I.C. Plastics, Inc.
 - 3. Proto Corporation
 - 4. Speedline Corporation
- B. Jacket: One-piece molded type fitting covers, off-white color.
 - a. PVC Plastic.
 - 2. Minimum Service Temperature: 0°F.

3. Maximum Service Temperature: 150°F.
 4. Moisture Vapor Permeability: 0.002 perm-inch, when tested in accordance with ASTM E96/E96M.
 5. Thickness: 20 mils.
- C. Connections: Brush on welding adhesive and pressure sensitive color matching vinyl tape.
- D. Insulation Protection System: Refrigerant piping insulation PVC protective cover.
1. PVC Insulation Cover Color: Black with full-length Velcro fastener.
 2. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Refrigerant Piping: Insulate with flexible elastomeric cellular insulation.
1. Insulate suction line of cooling only systems.
 2. Insulate both refrigerant lines of heat pumps systems.
 3. City of Seattle: Insulate both refrigerant lines with ½-inch thickness indoors and 1-inch thickness outdoors.
 4. Exterior Applications: Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.
- D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with

- pressure-sensitive adhesive. Secure with outward clinch expanding staples.
- 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- G. Inserts and Shields:
 - 1. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 2. Insert location: Between support shield and piping and under the finish jacket.
 - 3. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Division 07.
- I. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV-resistant finish for flexible elastomeric cellular insulation without jacketing.

3.2 PIPING INSULATION SCHEDULE

DESIGN OPERATING TEMP. RANGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE DIAMETER (INCHES)				
	CONDUCTIVITY RANGE (BTU-IN/HR.·FT. ² .°F)	MEAN RATING TEMP. (°F)	<1	<1 TO <1½	1½ TO <4	4 TO <8	>8
HEATING SYSTEMS							
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
COOLING AND REFRIGERANT SYSTEMS							
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
BELOW 40	0.20 – 0.26	75	0.5	0.5	1.0	1.0	1.5
MISCELLANEOUS SYSTEMS							
ALL	0.22 – 0.28	100	1.0	1.5	1.5	1.5	2.0

END OF SECTION 23 07 19

SECTION 23 08 00 – HVAC SYSTEMS COMMISSIONING**PART 1 – GENERAL****1.1 COMMISSIONING AGENCY**

- A. The commissioning agency (CA) shall be provided by the contractor for this project. The CA has overall responsibility for planning and coordinating the commissioning process. However, commissioning involves all parties to the design and construction process, including the mechanical (Division 23) contractor, and all specialty subcontractors within Division 23, such as sheet metal, piping, refrigeration, water treatment, and controls, plus major equipment suppliers as required.

1.2 CONTRACTOR RESPONSIBILITY

- A. The mechanical (Division 23) contractor's responsibilities are defined in Section 01 91 13 of the specifications. These responsibilities apply to all specialty subcontractors and major equipment suppliers within Division 23. Each contractor and supplier shall review Section 01 91 13, and their bids shall include provisions for carrying out the work described, as it applies to each Section within the Division 23 specifications, individually and collectively.

END OF SECTION 23 08 00

SECTION 23 09 13 – INSTRUMENTATION AND CONTROL DEVICES FOR HVAC**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Control Valves:
 - 1. Ball valves with factory-mounted actuators.
 - 2. Globe valves with factory-mounted actuators.
 - 3. Electronic valve operators.
- B. Damper Operators:
 - 1. Electric operators.
- C. Thermostats:

1.2 REFERENCE STANDARDS

- A. ANSI/FCI 70-2 – Control Valve Seat Leakage.

1.3 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- E. Project Record Documents: Record actual location of control components, including panels, thermostats, and sensors.
 - 1. Revise shop drawings to reflect actual installation and operating sequences.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

PART 2 – PRODUCTS

2.1 EQUIPMENT – GENERAL

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.2 CONTROL VALVES

- A. Ball Valves with Factory-Mounted Actuators:
1. Manufacturers:
 - a. Belimo.
 - b. Johnson Controls.
 - c. Schneider Electric.
 - d. Siemens
 2. Service: Use for hot water.
 3. Flow Characteristic: Include 2-way operation configured to fail normally closed (NC).
 4. Replacements in Kind: Provide pressure-independent type.
 5. Rangeability: 500 to 1.
 6. ANSI Rating: Class 150.
 7. Leakage: Class IV (0.1% of rated capacity) per ANSI/FCI 70-2.
 8. Body Size:
 - a. Under 2-½ inches:
 - 1) Connection: NPT.
 - 2) Materials:
 - i. Body: Brass.
 - ii. Flanges: Ductile iron.
 - iii. Ball: Chrome-plated brass.
 - iv. Stem: Nickel-plated brass.
 - v. Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
 - vi. Stem Seal: EPDM O-Rings.
 - vii. Flow Control Disk: Thermoplastic synthetic-resin.
 - b. Service Temperature:
 - 1) Fluid Side: 0 to 284°F liquid or 25 psig steam.
 - 2) Ambient Side: From -4 to 122°F.
 9. Actuator Requirements:
 - a. Assembly: Factory-mounted.
 - b. Input: 0 to 5 VDC configured for proportional control.

- c. Accessories: Provide with valve position indicator and manual override.
 - B. Globe Valves with Factory-Mounted Actuators:
 - 1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with back seating capacity repackable under pressure.
 - 2. Hydronic Systems:
 - a. Rate for service pressure of 125 psig at 250°F.
 - b. Replaceable plugs and seats of stainless steel.
 - c. Size for 3 psig maximum pressure drop at design flow rate.
 - d. Provide two-way valves with equal percentage characteristics and three-way valves with linear characteristics. Size two-way valve operators to close valves against pump shutoff head.
 - C. Electronic Valve Actuators:
 - 1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
 - 2. Select operator for full shut-off at maximum pump differential pressure.
- 2.3 DAMPER OPERATORS
 - A. General:
 - 1. Provide actuators with torque capacity sized for minimum of 20% greater than maximum design stream velocity and hold tight seal against maximum system pressures.
 - 2. Provide spring return for two position control and for fail safe operation.
 - 3. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
 - 4. Provide one operator for maximum 36 sq ft damper section.
 - 5. See Section 25 35 13 for field-mount damper actuators and operators.
 - B. Electric Operators:
 - 1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.
- 2.4 THERMOSTATS
 - A. Programmable Room Thermostats: Programmable type with seven-day programming for two occupied and two unoccupied periods per day; individual occupied and unoccupied set points; three-hour override of unoccupied program with automatic return to programmed schedule; battery back-up with

rechargeable nicad battery; fan “auto” cycle available for both occupied and unoccupied cycles; automatic changeover on heating/cooling sequences.

PART 3 – EXECUTION**3.1 INSTALLATION**

- A. Install in accordance with manufacturer’s instructions.
- B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats; see Section 26 27 26.
- C. Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION 23 09 13

SECTION 23 21 13 – HYDRONIC PIPING**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Heating water piping, above grade.
- C. Valves:
 - 1. Ball valves.
 - 2. Pressure independent temperature control valves and balancing valves.

1.2 RELATED REQUIREMENTS

- A. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ANSI/FCI 70-2 – Control Valve Seat Leakage.
 - 2. ASME B16.3 – Malleable Iron Threaded Fittings: Classes 150 and 300.
 - 3. ASME B16.5 – Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard.
 - 4. ASME B16.15 – Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
 - 5. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
 - 6. ASME B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - 7. ASME B16.34 – Valves — Flanged, Threaded, and Welding End.
 - 8. ASME B16.51 – Copper and Copper Alloy Press-Connect Pressure Fittings.
 - 9. ASME B31.9 – Building Services Piping.
 - 10. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 11. ASTM A106/A106M – Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
 - 12. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 13. ASTM A183 – Standard Specification for Carbon Steel Track Bolts and Nuts.

14. ASTM A234/A234M – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
15. ASTM A536 – Standard Specification for Ductile Iron Castings.
16. ASTM B32 – Standard Specification for Solder Metal.
17. ASTM B88 – Standard Specification for Seamless Copper Water Tube.
18. ASTM B88M – Standard Specification for Seamless Copper Water Tube (Metric).
19. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
20. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications.
21. ASTM D2235 – Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
22. ASTM D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
23. ASTM D2310 – Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
24. ASTM D2466 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
25. ASTM D2467 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
26. ASTM D2680 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
27. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
28. ASTM D2855 – Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
29. ASTM F1960 – Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing.
30. ASTM F708 – Standard Practice for Design and Installation of Rigid Pipe Hangers.
31. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

32. ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.
33. ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
34. ASTM F2389 – Standard Specification for Pressure-Rated Polypropylene (PP) Piping Systems.
35. ASTM F1960 – Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing.
36. AWS A5.8M/A5.8 – Specification for Filler Metals for Brazing and Braze Welding.
37. AWS D10.12M/D10.12 – Guide for Welding Mild Steel Pipe.
38. AWWA C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
39. AWWA C110/A21.10 – Ductile-Iron and Gray-Iron Fittings.
40. AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
41. AWWA C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast.
42. AWWA C606 – Grooved and Shouldered Joints.
43. DIN 4726 – Warm Water Surface Heating Systems and Radiator Connecting Systems – Plastics Piping Systems and Multilayer Piping Systems.
44. MSS SP-58 – Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.
45. PPI TR-4 – PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.

1.4 SCHEDULING: SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Product Data:
 1. Include data on valves and accessories.
 2. Provide manufacturers catalog information.
 3. Indicate valve data and ratings.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 – PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping and fittings as indicated, and as follows:
 - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
- C. Pipe-to-Valve Connections: Use flanges; unions; or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
 - 1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

2.2 HEATING WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
 - 1. Threaded Joints: ASME B16.3, malleable iron fittings.
 - 2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A); M (C); L (B); drawn, using one of the following joint types:
 - 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.

2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.51, utilizing EPDM, nontoxic synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Apollo Valves.
 - 2) FNW; Copper Press.
 - 3) Grinnell Products.
 - 4) Or approved equal.

2.3 BALL VALVES

A. Manufacturers:

1. Anvil International.
2. Apollo Valves.
3. Grinnell Products.
4. NIBCO, Inc.
5. Shurjoint Piping Products, Inc.
6. Victaulic Company.
7. Watts.

B. Up To and Including 2 Inches:

1. Bronze; Stainless steel; Brass; one-piece body, chrome plated brass or stainless steel ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends with union.

2.4 PRESSURE INDEPENDENT TEMPERATURE CONTROL AND BALANCING VALVES

A. Manufacturers:

1. Belimo.
2. Danfoss.
3. Griswold Controls
4. Johnson Controls.
5. Schneider Electric.
6. Siemens USA.

- B. Control Valves: Factory-fabricated pressure independent with internal differential pressure regulator (DPRV), which automatically adjusts to normal changes in system pressure and provides 100% control valve authority at all positions of the valve.
1. Maintain proportional and linear flow coil characteristics.
 2. PICV to accurately control the flow from 0 to 100% full rated flow with an operating pressure differential range of 3 to 60 psig.
 3. Provide ANSI/FCI 70-2 Class 4 shutoff on all sizes and field serviceable.
 4. Provide control valve to incorporate control, balancing, and flow limiting. Hydronic system pressure independent control valve bodies to comply with ASME B16.34 or ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150% of the system design operating pressure and have the following characteristics:
 - a. 2 NPS and Smaller: Class 150 bronze or brass body with union connections, stainless steel trim, stainless steel rising stem, stainless steel disc or ball, and screwed ends with backseating capacity repackable under pressure.
 - b. Pressure Control Seat: Brass construction with vulcanized EPDM.
 - c. Sizing: Line-size.
 - d. Fittings and Components: All fittings and components to meet ANSI standards and be compatible with readily available components.
 - e. Close-Off (Differential) Pressure Rating: Combination of actuator, DPRV action, and trim to provide a minimum close-off pressure rating of 150% of total system (pump) head. Provide actuator from the same manufacturer as the pressure independent control valve, unless approved otherwise.
- C. Electronic Actuators: Direct-mounted, self-calibrating type designed for minimum 60,000 full-stroke cycles at rated force.
- D. Provide actuator with visible position indication. Fail positions on power failure to include in-place, open or closed as indicated in the controls specifications.
1. Valves: Sized for maximum circuit flow rate and nominally, line-sized.
 2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 3. Fail-Safe Operation: Mechanical, spring-return mechanism or capacitance return.
 4. Power Requirements (Two-Position Spring Return): 24 VAC.
 5. Proportional Signal: 0 to 10 VDC or 2 to 10 VDC or 4 to 20 mA, and 2 to 10 VDC position feedback signal.

6. Provide plenum-rated actuators for service above ceilings to possess UL listings and approvals.
7. Temperature Rating: 40 to 104°F.

PART 3 – EXECUTION**3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- D. After completion, fill, clean, and treat systems.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install heating water piping to ASME B31.9 requirements.
- C. Install valves with stems upright or horizontal, not inverted.

END OF SECTION 23 21 13

SECTION 23 31 00 – HVAC DUCTS AND CASINGS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Metal ducts.
- B. Manufactured ductwork and fittings.

1.2 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - 4. SMACNA (DCS) – HVAC Duct Construction Standards Metal and Flexible.

1.3 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Product Data: Provide data for duct materials.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.
- B. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 33 19.
- C. Duct Shape and Material in accordance with Allowed Static Pressure Range:
 - 1. Round: ± 2 in-wc of galvanized steel.
 - 2. Rectangular: $\pm \frac{1}{2}$ in-wc of galvanized steel.
- D. Duct Sealing and Leakage in accordance with Static Pressure Class:
 - 1. Low Pressure Service: Up to 2 in-wc:
 - a. Seal: Class C, apply to seal off transverse joints.
 - b. Leakage:

- 1) Rectangular: Class 24 or 24 cfm/100 sq ft.
 - 2) Round: Class 12 or 12 cfm/100 sq ft.
2. Low Pressure Service: From 2 in-wc to 3 in-wc:
 - a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.
 - b. Leakage:
 - 1) Rectangular: Class 12 or 12 cfm/100 sq ft.
 - 2) Round: Class 6 or 6 cfm/100 sq ft.
- E. Duct Fabrication Requirements:
1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
 2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
 3. Construct tees, bends, and elbows with radius of not less than 1-½ times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
 4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
 5. Increase duct sizes gradually, not exceeding 15° divergence wherever possible; maximum 30° divergence upstream of equipment and 45° convergence downstream.
 6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
 7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.2 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).

- B. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.
- C. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.
- D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION 23 31 00

SECTION 23 33 00 – AIR DUCT ACCESSORIES**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers – metal.
- C. Fire dampers.
- D. Duct access doors.
- E. Duct test holes.
- F. Flexible duct connectors.
- G. Volume control dampers.

1.2 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - 2. NFPA 92 – Standard for Smoke Control Systems.
 - 3. SMACNA (DCS) – HVAC Duct Construction Standards Metal and Flexible.
 - 4. UL 555 – Standard for Fire Dampers.
 - 5. UL 555C – Standard for Safety Ceiling Dampers.

1.3 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC, for submittal procedures.
- B. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

PART 2 – PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS – METAL

- A. Manufacturers:
 - 1. Nailor Industries, Inc.
 - 2. Pottorff

- 3. Ruskin Company.
 - 4. United Enertech.
 - B. Gravity Backdraft Dampers, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- 2.3 DUCT ACCESS DOORS
- A. Manufacturers:
 - 1. Acudor Products Inc, a Division of Nelson Industrial Inc.
 - 2. Ductmate Industries, Inc, a DMI Company.
 - 3. Elgen Manufacturing, Inc.
- 2.4 DUCT TEST HOLES
- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- 2.5 FIRE DAMPERS
- A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
 - B. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for closure under air flow conditions. Configure with blades out of air stream except for 1-inch pressure-class ducts up to 12 inches in height.
- 2.6 FLEXIBLE DUCT CONNECTORS
- A. Manufacturers:
 - 1. Carlisle HVAC Products.
 - 2. Duro Dyne Corp.
 - 3. Elgen Manufacturing, Inc.
 - 4. Ventfabrics, Inc.
 - B. Fabricate in accordance with SMACNA (DCS) and as indicated.
 - C. Flexible Duct Connections: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
 - a. Net Fabric Width: Approximately 2 inches wide.
 - 2. Metal: 3 inches wide, 24 gauge, 0.0239-inch-thick galvanized steel.
- 2.7 VOLUME CONTROL DAMPERS
- A. Manufacturers:
 - 1. AireTechnologies, Inc. a DMI Company.
 - 2. Louvers & Dampers, Inc. a brand of Mestek, Inc.

3. Elgen Manufacturing Company, Inc.
 4. MKT Metal Manufacturing.
 5. Nailor Industries, Inc.
 6. NCA, a brand of Metal Industries Inc.
 7. Pottorff.
 8. Ruskin Company.
 9. United Enertech.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Splitter Dampers:
1. Material: Same gauge as duct to size in either direction.
 2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 3. Operator: Minimum ¼ inch diameter rod in self-aligning, universal joint action, flanged bushing with set screw.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.
- B. Provide duct test holes where indicated and required for testing and balancing purposes.
- C. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion-resistant springs, bearings, bushings, and hinges.
- D. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

- H. Provide balancing dampers at each branch duct shaft penetration.
- I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly. Locate dampers as far upstream as possible and in accessible locations.
- J. Provide concealed type regulators, utilizing miter gears and universal joints as required, for dampers located above hard ceilings or in non-accessible locations.

END OF SECTION 23 33 00

SECTION 23 37 00 – AIR OUTLETS AND INLETS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Diffusers:
 - 1. Rectangular ceiling diffusers.
- B. Registers/grilles:
 - 1. Ceiling-mounted, egg crate exhaust and return register/grilles.
 - 2. Wall-mounted, exhaust and return register/grilles.
- C. Duct-mounted supply and return registers/louvers.

1.2 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. AAMA 2603 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
 - 2. AMCA 500-L – Laboratory Methods of Testing Louvers for Rating.
 - 3. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 4. ASTM B221M – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

1.3 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Krueger-HVAC.
- B. Price Industries.
- C. Shoemaker.
- D. Titus, a brand of Air Distribution Technologies.

2.2 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide square, adjustable pattern, stamped, multi-core diffuser to discharge air in an adjustable pattern.
- B. Connections: Rectangular.
- C. Frame: 1¼ inch margin with countersunk screw mounting for surface mounting.
- D. Frame: Channel lay-in frame for suspended grid ceilings.
- E. Fabrication: Steel with baked enamel finish.
- F. Color: white.

2.3 DUCT-MOUNTED SUPPLY AND RETURN REGISTERS/LOUVERS

- A. Type: Duct-mounted, rectangular register for round-spiral duct with adjustable pivot-ended blades, end caps, built-in volume damper, and dual cover flanges to lay flush on duct surface regardless of diameter. Performance to match manufacturer's catalog data.

2.4 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

- A. Type: Egg crate style face consisting of ½- by ½- by ½-inch grid core.
- B. Fabrication: Grid core consists of aluminum with mill aluminum finish.
- C. Color: To be selected by Construction Management/ Architect from manufacturer's standard range.
- D. Frame: 1¼ inch margin with countersunk screw mounting for surface mounting.
- E. Frame: Channel lay-in frame for suspended grid ceilings.
- F. Accessories: Provide integral gang and face operated opposed blade damper, 2-inch filter frame, plaster frame, square mesh insect screen, square mesh debris screen, prescored molded fiberglass back, and 45-degree angled eggcrate or other similar provisions for visual blocking such as angled louver or 90-degree duct elbow.

2.5 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, ¾ inch minimum depth, ¾ inch maximum spacing, with spring or other device to set blades, vertical face.

PART 3 – EXECUTION**3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

- C. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

END OF SECTION 23 37 00

SECTION 23 72 26 – INDOOR ENERGY RECOVERY VENTILATORS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Energy recovery ventilators.

1.2 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. AHRI 1060 (I-P) – Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.
 - 2. ASHRAE Std 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 - 3. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 4. NFPA 70 – National Electrical Code.
 - 5. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.
 - 6. UL 1995 – Heating and Cooling Equipment.

1.3 SUBMITTALS

- A. See Section 23 05 00– Common Work Results for HVAC for submittal procedures.
- B. Product Data: Manufacturer’s installation instruction, product data, and engineering calculations.
- C. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.

PART 2 – PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723 .

2.2 MANUFACTURERS

- A. Energy Recovery Ventilators:
 - 1. Cook.
 - 2. Greenheck Fan Corporation.
 - 3. Oxygen8.
 - 4. RenewAire.

- 5. Valent.
- 6. S&P

2.3 INDOOR ENERGY RECOVERY VENTILATORS

- A. Energy Recovery Ventilators: Provide stationary core air-to-air exchanger; prefabricated packaged system designed by manufacturer.
 - 1. Provide unit with a AHRI 1060 (I-P) compliant air-to-air exchanger.

2.4 CASING

- A. Construction: Single wall, minimum 22 gauge galvanized steel sheet. Galvanized steel framing.
- B. Coating: Baked powder paint.
- C. Access: Hinged and/or screwed access panels.
- D. Insulation: 1 inch insulated fiberglass with FSK facing.
 - 1. Secure insulation to unit with waterproof adhesive and permanent mechanical fasteners.

2.5 FANS

- A. Provide separate fans for exhaust and supply blowers.
- B. Fans:
 - 1. Common driven with one motor.
- C. Housings: 12 gauge, 0.1046 inch aluminized steel with plenums integral to general housing and constructed to Class 1 fan standards.
- D. Motors:
 - 1. Motors: Electronically commutated (EC).
 - 2. Efficiency: High.
 - 3. Speed: Single.
 - 4. Control: Constant Speed.
 - 5. Fan Motor: UL listed and labeled.

2.6 STATIONARY ENERGY RECOVERY CORE

- A. Stationary Core: AHRI 1060 (I-P) certified, air-to-air energy exchanger with evenly spaced and sealed plates arranged for counter airflow.
- B. Plate Material: Washable, polymer fiber membrane with selective hydroscopic and moisture permeability, and gas barrier properties.

2.7 SUPPLEMENTAL ELECTRIC HEATING COIL

- A. Coil must be an electric duct heater in accordance with UL 1995 and NFPA 70. Coil must be duct- or unit-mounted. Coil must be of the single stage type.

- B. Coil must be provided with a built-in or surface-mounted high-limit thermostat interlocked electrically so that the coil cannot be energized unless the fan is energized.
- C. Coil casing and support brackets must be of galvanized steel or aluminum. Coil must be mounted to eliminate noise from expansion and contraction and be completely accessible for service.

2.8 FILTERS

- A. Exhaust and Fresh Air Streams: MERV 8 and 13 filters constructed to meet ASHRAE Std 52.2.

2.9 POWER AND CONTROLS

- A. Provide single-point field connection to power supply.
- B. Provide non fused main disconnect integral to control panel.
- C. Provide additional dry contact availability for connection of existing fume hood exhaust fan.
- D. Install wiring in accordance with NFPA 70.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify that structure is ready for installation of unit, that openings in deck for ductwork, if required, are correctly sized and located, and that mechanical and electrical utilities supplying unit are of correct capacities and are accessible.

3.2 INSTALLATION

- A. Provide openings for suitable ductwork connection.

3.3 CLEANING

- A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

END OF SECTION 23 72 26

SECTION 23 81 29 – VARIABLE REFRIGERANT FLOW HVAC SYSTEMS**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Air-source outdoor units.
- B. Refrigerant piping.
- C. Indoor units.
- D. Indoor fan coil units.

1.2 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. AHRI 210/240 – Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - 2. AHRI 1230 – Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment.
 - 3. ASCE 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
 - 4. ITS (DIR) – – Directory of Listed Products.
 - 5. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 6. NFPA 70 – National Electrical Code.
 - 7. UL 1995 – Heating and Cooling Equipment.

1.3 SUBMITTALS

- A. See Section 23 05 00 – Common Work Results for HVAC for submittal procedures.
- B. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:
 - 1. Detailed piping diagrams, with branch balancing devices.
 - 2. Condensate piping routing, size, and pump connections.
 - 3. Detailed power wiring diagrams.
 - 4. Detailed control wiring diagrams.
 - 5. Locations of required access through fixed construction.
 - 6. Drawings required by manufacturer.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Daikin.
- B. York Solution.
- C. Samsung.
- D. VTS.
- E. Mitsubishi/Trane.

2.2 VARIABLE REFRIGERANT FLOW SYSTEM

- A. Minimum System Requirements:
 - 1. System Testing, Capacity Rating, and Performance:
 - a. AHRI 1230 when cooling capacity is equal or greater than 65,000 Btu/h.
 - b. AHRI 210/240 when cooling capacity is below 65,000 Btu/h.
 - 2. Safety Certification: Bear UL 1995 tested and ITS (DIR) listed certification label.
 - 3. Outdoor Units: Furnish installation and surface support hardware products in accordance with ASCE 7 for wind restraint.
 - 4. Cooling Mode Interior Performance:
 - a. Daytime Setpoint: 68°F, ± 2°F.
 - b. Setpoint Range: 57°F to 77°F.
 - c. Night Setback: 78°F.
 - d. Interior Relative Humidity: 20%, maximum.

2.3 AIR-SOURCE OUTDOOR UNITS

- A. Air Conditioning Type:
 - 1. DX refrigeration unit piped to one or more compatible indoor units either directly or indirectly through one or more intermediate refrigeration branch units.
- B. Unit Cabinet:
 - 1. Capable of being installed with wiring and piping to the left, right, rear or bottom.
 - 2. Designed to allow side-by-side installation with minimum spacing and vibration isolation.
 - 3. Weatherproof and corrosion-resistant; rust-proofed mild steel panels coated with baked enamel finish.

4. Sound Pressure Level: 55 dB measured at 3 feet from front of unit.
- C. Heat Sink Side:
1. Condenser Fans:
 - a. Provide minimum of 2 fans for each condenser within the outdoor unit.
 - b. Minimum External Static Pressure: Factory set at 0.12 in-wc.
 - c. Fan Type: Vertical discharging, direct-driven propeller type with variable speed operation using DC-controlled ECM motors mechanically connected using permanently lubricated bearings having whole assembly protected with fan guards.
 2. Condenser Coils:
 - a. Hi-X seamless copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.
- D. Refrigeration Side:
1. Factory assembled and wired with instrumentation, switches, and controller(s) to handle unit specifics with direct coordination of remote controller(s) from indoor unit(s).
 2. Refrigeration Circuit: ECM driven dual scroll compressors, fans, condenser heat sink coil, expansion valves, solenoid valves, distribution headers, capillaries, filters, shutoff valves, oil separators, service ports, and refrigerant regulator.
 3. Refrigerant: R32 factory charged. Controller to alarm when charge is below capacity.
 4. Variable Volume Control: Modulate compressed refrigerant capacity automatically to maintain constant suction and condensing pressures under varying refrigerant volume required to handle remote loads. Include defrost control.
 5. Provide refrigerant subcooling to ensure the liquid refrigerant does not flash when supplying to use indoor units.
 6. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle, oil return, or defrost is not permitted due to potential reduction in space temperature.
 7. Power Failure Mode: Automatically restarts operation after power failure without loss of programmed settings.
 8. Safety Devices: High pressure sensor with cut-out switch, low pressure sensor with cut-out switch, control circuit fuses, crankcase heaters, fusible

plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, overcurrent protection for the inverter and antirecycling timers.

9. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.

E. Local Controls.

F. Power:

1. Electrical Requirement: 208 to 230 VAC, 1-phase, 60 Hz.
2. Outdoor Mounted: Provide fused NEMA 250 Type 4X disconnect switch.

2.4 REFRIGERANT PIPING

- A. Two-Pipe Run: Provide low-pressure vapor and high-pressure vapor gas pipes for each indoor unit selected for seasonal heating or cooling service.
- B. Three-Pipe Run: Provide low-pressure vapor, high-pressure vapor gas, and liquid pipes for each indoor unit selected for off-season heating and cooling changeover service.
- C. Refrigerant Flow Balancing: Provide refrigerant piping joints and headers specifically designed to ensure proper refrigerant balance and flow for optimum system capacity and performance; T-style joints are prohibited.

2.5 INDOOR UNITS

A. Minimum Unit Requirements:

1. DX Evaporator Coil:
 - a. Copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
 - b. 2-, 3-, or 4-row cross fin design with 14 to 17 fins per inch and flare end-connections.
 - c. Provide thermistor on liquid and gas lines wired into local controller.
 - d. Refrigerant circuits factory-charged with dehydrated air for field charging.
2. Fan Section:
 - a. Variable or three-speed ECM fan with automatic airflow adjustment; external static pressure selectable during commissioning.
 - b. Thermally protected, direct-drive motor with statically and dynamically balanced fan blades.
 - c. Minimum-adjustable external static pressure 0.32 in-wc; provide for mounting of field-installed ducts.

3. Local Unit Controls:
 - a. Temperature Control: Return air control using thermistor tied to computerized Proportional-Integral-Derivative (PID) control of superheat.
 - b. Temperature Zones:
 - 1) Single Indoor Unit: Set served space(s) as the local temperature zone.
 - 2) Multiple Indoor Units: For large zones, group and coordinate related indoor units with served spaces as the local temperature zone with each indoor unit as sub-zone.
4. Return Air Filter:
5. Condensate:
 - a. Built-in condensate drain pan with PVC drain connection for drainage.
 - b. Units with Built-In Condensate Pumps: Provide condensate safety shutoff and alarm.
 - c. Units without Built-In Condensate Pump: Provide built-in condensate float switch and wiring connections.
6. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

2.6 INDOOR FAN COIL UNITS

- A. Factory complete, tested, and pre-wired with all necessary electronic and refrigerant controls.
- B. Equipped with auto-restart function and test run capability either via a switch or controller.
- C. Refrigerant: Refrigerant circuits factory-charged with dehydrated inert gas.
- D. Coils: Direct expansion type constructed from copper, aluminum, or copper and aluminum.
- E. Fans: Direct-drive, with statically and dynamically balanced impellers; variable speed ECM unless otherwise indicated; motor thermally protected.
- F. Return Air Filter: Washable long-life net filter with mildew proof resin, or replaceable, unless otherwise indicated.
- G. Condensate Drainage: Built-in condensate drain pan with drain connection.
- H. Dedicated electronic modulating refrigerant expansion and flow control.
- I. Unit must be in accordance with UL 1995 and AHRI 1230.

- J. For units with Built-In Condensate Pumps, provide condensate safety shutoff and alarm. For units without Built-In Condensate Pump, provide built in or field supplied overflow protection.
- K. Concealed-in-Ceiling Units
 - 1. Ducted horizontal discharge and return; galvanized steel cabinet.
 - 2. Field adjustable external static pressure switch for high efficiency filter operation.
 - 3. Switch box accessible from side or bottom.

PART 3 – EXECUTION**3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install refrigerant piping in accordance with equipment manufacturer's instructions.
- C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).
- D. Coordinate with installers of systems and equipment connecting to this system.

3.2 SYSTEM STARTUP

- A. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.
- B. Adjust equipment for proper operation within manufacturer's published tolerances.

END OF SECTION 23 81 29

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SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. This section specifies general requirements for electrical system installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in sections of Division 1.
- B. Provide all required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, and test equipment, and satisfactorily complete all electrical work shown on the Drawings, included in these Specifications, or required for a complete and fully operating facility. In addition, provide wiring for the equipment that will be provided under other Divisions of these Specifications.
- C. It is the intent of the Contract Documents to provide an installation complete in every respect. If additional details, manufacturer installation details/instructions, or special construction is required for work indicated or specified under this section of work or work specified in other sections, provide material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.
- D. The division 26 documents provide a basis for design and include options and flexibility for the contractor to install the electrical equipment, based on the drawings. If the contractor finds a product they would like to use on this project and it is not listed in the contract documents, the contractor is required to submit a substitution for engineer approval. Clearly identifying all substituted equipment and materials during the submittal process is required.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.
 - 1. Section 01 70 00 – Execution and Closeout Requirements: Additional requirements for alterations work.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ICC (IBC) – International Building Code.
 - 2. ICC (IFC) – International Fire Code.
 - 3. ICC (IFGC) – International Fuel Gas Code.
 - 4. ICC (IMC) – International Mechanical Code.

5. NETA ATS – Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.
 6. NFPA 70 – National Electrical Code.
 7. Washington State Energy Code, Commercial Provisions. Applicable State and local codes, laws, and ordinances.
- B. The publications listed above form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.

1.4 DEFINITIONS

- A. Provide: Furnish and install complete and ready for intended use.
- B. Indicated: Indicated on drawings.
- C. Noted: Noted on Drawings or in Specifications.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.5 SUBMITTALS

- A. Refer to Division 01 requirements for submittal definitions, requirements, and procedures. Additional requirements are listed below.
- B. Submit a single, complete submittal package for products in Division 26. Submittal package shall be organized by equipment type. PDFs shall be bookmarked.
- C. Nameplate schedule.
- D. Conduit tag schedule.
- E. Qualifications of testing organization and personnel meeting requirements of NETA ATS Section 3.

- F. Inspection and acceptance testing reports per NETA ATS for equipment for which tests are required in this section.
- G. Field test results specified in Subsection 3.03.
- H. Submittals not meeting the following requirements will be returned for revision:
 - 1. Provide a cover page for each item or group of items.
 - 2. Submittal package shall be organized by equipment type.
 - 3. Each cover page must be clearly identified with the project name, specification number, and paragraph number.
 - 4. Submittal package must be accompanied by an itemized index listing specification section, paragraph number, item, and manufacturer; larger projects will be index tabbed by specification section with index for each section.

1.6 DRAWINGS AND SCHEDULES

- A. Drawings and Specifications supplement each other, and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings but which are obviously necessary to make a complete working installation shall be included.
- B. Electrical drawings shall serve as working drawings for Division 26 work. Refer to Architectural, Structural, and Mechanical drawings for additional detail affecting the installation of work.
- C. The Electrical Drawings are diagrammatic. The approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details regarding location. Exact locations are to be determined by actual measurements at the building and shall be verified with the Engineer prior to installation. Except where special details are used to illustrate the method of installation of a particular piece or type of equipment or material, the requirements or descriptions in this section shall take precedence in the event of conflict.
- D. Field-verify scaled dimensions on Drawings.
- E. Review the drawings and specification divisions of other trades and perform the electrical work that will be required for the installations.
- F. Submit in writing to the Construction Management details of any proposed changes in or departures from these Contract Documents along with the reasons, therefore. Make no changes or departures without the prior written favorable review of the Construction Management.
- G. Maintain a set of As-Built Drawings on-site that documents changes made. Upon completion of the work, transfer these changes to a clean set of full-size

drawings with red ink to indicate additions and green ink to indicate deletions. Submit these full-size drawings to the Construction Manager.

1.7 DEVIATIONS

- A. Conduit size, wire size/quantities/type, estimated wire length and all other values are based on the information and design contract requirements available during the design. Changing site/project conditions, substitutions, Construction Management-requested changes, and Contractor-approved changes may affect the values in the schedule. All power studies shall require the Contractor to field-verify cable lengths based on field conditions and not on the estimated lengths in this table. The Contractor shall redline the schedule and provide the redlines to the Construction Manager depicting the “as constructed” project documents.

PART 2 – PRODUCTS

2.1 STANDARD

- A. Products that are specified by manufacturer, trade name, or catalog number, establish a standard of quality, and do not prohibit the use of equal products of other manufacturers provided they are favorably reviewed by the Construction Management prior to installation.
- B. It is the intent of these Specifications and Drawings to secure high quality materials and equipment to facilitate operation and maintenance of the facility. Equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these items. For uniformity, only one manufacturer will be accepted for each type of product. Equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for stresses that may occur during fabrication, transportation, erection, and continuous or intermittent operation. Equipment shall be adequately stayed, braced, and anchored and shall be installed in a neat and skillful manner. Appearance, as well as utility, shall be given consideration in the design of details.
- C. Components and devices installed shall be standard items of industrial grade or better, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light-duty, fragile, and commercial grade devices of doubtful durability shall not be used.

2.2 MATERIALS

- A. Provide first quality, new materials, free from defects, and suitable for the intended use and space. Where two or more units of the same class of material are required, provide products of a single manufacturer.
- B. Unless otherwise indicated, provide materials and equipment that are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer’s latest standard design that conforms to these Specifications.

2.3 EQUIPMENT NAMEPLATES

- A. Provide nameplates on new and Owner-furnished equipment.
- B. Panel Nameplates: For equipment such as automatic transfer switches, switchgear, variable frequency drive (VFD) panels, motor starter panels, control panels, electrical equipment enclosures, disconnect switches, motors, and pumps, the nameplates shall be:
 - 1. Located on the enclosure face.
 - 2. Rectangular screw-on type with self-tapping 316 stainless steel screws.
 - 3. -inch-tall laminated phenolic plastic nameplate with white letters on black backgrounds. Length as required.
 - 4. -inch-high lettering for equipment name with ½-inch-high lettering for tag number.
 - 5. Nameplate text shall include:
 - a. Line 1: Descriptive name (e.g., “MAINTENANCE BYPASS AUTOMATIC TRANSFER SWITCH”).
 - b. Line 2: Asset Number (e.g., “ATS29-100”).
- C. Nameplate schedule shall be included with all equipment submittals.

2.4 GENERAL FASTENING AND SUPPORT HARDWARE

- A. Fasteners, anchors, clamps, supports, strut, plates, posts, and brackets shall be galvanized. Expansion shields and tamperproof pin style anchors are not acceptable. Size anchors to meet load requirements. Cut ferrous metal shall be coated with zinc-rich paint.

2.5 PAINTING AND COATING

- A. Equipment: Refer to each electrical equipment section of these Specifications for painting and coating requirements of equipment and enclosures. Repair any final finish that has been damaged or is otherwise unsatisfactory using touchup materials approved by the manufacturers, to the satisfaction of the Construction Management.

PART 3 – EXECUTION**3.1 GENERAL**

- A. Work shall be performed by craftsmen skilled in their trade. Work shall present a neat, finished appearance.
- B. Install equipment in strict accordance with the manufacturer’s instructions unless directed otherwise. Wherever a conflict occurs between manufacturer’s instructions, codes and regulations, or these Contract Documents, follow Construction Management’s direction. Keep a copy of manufacturer’s installation instructions on the job site available for review at times.

- C. Provide protection for materials and equipment against loss or damage. Protect everything from the effects of weather. Prior to installation, store items in indoor locations. In addition, items subject to corrosion under damp conditions, and items containing insulation, such as transformers, motors, and control, shall be stored in indoor, heated, dry locations.
- D. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction.
- E. Do not cut or notch any structural member or building surface without specific approval of Construction Management. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition using skilled craftsmen of the trades involved at no additional cost to the Owner/ Construction Manager.
- F. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of devices and equipment. Touch up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.
- G. Label electrical and control equipment, including electrical switchgear, VFD panels, motor starter panels, generator sets, automatic transfer switches, control panels, equipment within electrical and control panels, disconnect switches, motors, pumps, local control stations, instrument transmitters, analytical controllers.

3.2 GROUNDING

- A. Bond and ground equipment for which a ground connection is required per NFPA 70 whether not specifically shown on the Drawings.

3.3 DAMAGED PRODUCTS

- A. Notify the Construction Management in writing when any equipment or material is damaged.
- B. Obtain prior favorable review by the Construction Management before making repairs to damaged products.

3.4 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Beginning of demolition means installer accepts existing conditions.

3.5 JOB CONDITIONS**A. Operations:**

1. Keep power shutdown periods to a minimum.
2. Carry out shutdowns only after the Construction Management has favorably reviewed the schedule.
3. Shutdowns to be scheduled with Construction Manager no less than 2 weeks in advance.

B. Construction Power:

1. Arrange for the required construction power.
2. When required, provide equipment, materials, and wiring in accordance with the applicable codes and regulations.
3. Upon completion of the project, remove temporary construction power equipment, material, and wiring from the site as the property of the Contractor.
4. Storage: Provide conditioned storage for equipment and materials per manufacturer's requirements that will become part of the completed facility so that it is protected from weather, dust, water, or construction operations.

3.6 LOCATIONS

A. General: Use equipment, materials, and wiring methods suitable for the types of locations in which they are located, as defined in Paragraph B herein.

B. Definitions of Types of Locations:

1. **Dry Locations:** Indoor areas which do not fall within the definitions below for Wet, Damp, Hazardous, or Corrosive Locations and that are not otherwise designated on the Drawings.
2. **Wet Locations:** Locations exposed to the weather, whether under a roof or not, or designated as Wet Locations by applicable codes and regulations, unless otherwise designated on the Drawings.
3. **Damp Locations:** Location wholly or partially underground; or having a wall or ceiling forming part of a channel or tank; or designated as Damp Locations by applicable codes and regulations, unless otherwise designated on the Drawings.
4. **Hazardous:** Hazardous locations per NFPA 70 Article 501 are identified in the Drawings.

3.7 SAFETY OF PERSONS AND PROPERTY

A. Comply with applicable laws, ordinances, rules, and regulations of any public authority for the safety of persons and property, including requirements of the Washington Department of Safety and Health (DOSH) or the Occupational

Safety and Health Act (OSHA) whichever is most stringent, and Division 01, General and Supplementary Conditions.

3.8 GUARANTEE

- A. Guarantee satisfactory operation of material and equipment installed under Division 26. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from date of Substantial Completion.

3.9 PERMITS AND FEES

- A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

3.10 FIELD TESTS

- A. Perform inspection and acceptance testing and submit test reports for the equipment specified in this section.
- B. Give a 2-week notice to the Construction Management prior to any test to permit witnessing the test.
- C. Retesting will be required for unsatisfactory tests after the equipment or system has been repaired. Retest related equipment and systems if required by the Construction Management. Repair and retest equipment and systems that have been satisfactorily tested but later fail, until satisfactory performance is obtained.

3.11 CLEANING AND REPAIR

- A. See Division 01 for additional requirements.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.
- C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 26 05 00

SECTION 26 05 05 – SELECTIVE DEMOLITION FOR ELECTRICAL**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Electrical demolition.

1.2 RELATED REQUIREMENTS

- A. Division 00.
- B. Division 01
- C. Division 26.

1.3 SUBMITTALS

- A. See Section 26 05 00 – Common Work Results for Electrical for submittal procedures.
- B. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Demolition drawings are based on casual field observation.
- C. Report discrepancies to Owner before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

- A. Coordinate the lab with the sequence of construction.
- B. Coordinate the demo with the construction scope of work.
- C. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- D. Coordinate utility service outages with the facility management/operator.
- E. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- F. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
 2. Make temporary connections to maintain service in areas adjacent to work area.
- G. Existing Fire Alarm System: Maintain existing system in service.
- H. Existing Telephone, Data and power Systems: Maintain existing systems in service.
- I. Existing Lighting System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
 2. Make temporary connections to maintain service in areas adjacent to work area.
- 3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK
- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
 2. PCB- and DEHP-containing lighting ballasts.
 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultraviolet, high-pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- F. Repair adjacent construction and finishes damaged during demolition and extension work.
- G. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

- H. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

- A. See Division 01 and Division 00 for additional requirements.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.
- C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 26 05 05

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Single conductor building wire.
- B. Underground feeder and branch-circuit cable.
- C. Service entrance cable.
- D. Metal-clad cable.
- E. Power and control tray cable.
- F. Manufactured wiring systems.
- G. Wiring connectors.
- H. Electrical tape.
- I. Heat-shrink tubing.
- J. Oxide inhibiting compound.
- K. Wire pulling lubricant.
- L. Cable ties.
- M. Firestop sleeves.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 05 – Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- C. Section 26 05 53 – Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ASTM B3 – Standard Specification for Soft or Annealed Copper Wire.
 - 2. ASTM B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
 - 3. ASTM B33 – Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.
 - 4. ASTM B787/B787M – Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation.

5. ASTM B800 – Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes – Annealed and Intermediate Tempers.
6. ASTM B801 – Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation.
7. ASTM D3005 – Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.
8. ASTM D4388 – Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes.
9. FS A-A-59544 – Cable and Wire, Electrical (Power, Fixed Installation).
10. NECA 1 – Standard for Good Workmanship in Electrical Construction.
11. NECA 104 – Standard for Installing Aluminum Building Wire and Cable.
12. NECA 120 – Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable.
13. NECA 121 – Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF).
14. NEMA WC 70 – Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
15. NETA ATS – Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.
16. NFPA 70 – National Electrical Code.
17. UL 4 – Armored Cable.
18. UL 44 – Thermoset-Insulated Wires and Cables.
19. UL 83 – Thermoplastic-Insulated Wires and Cables.
20. UL 183 – Manufactured Wiring Systems.
21. UL 267 – Outline of Investigation for Wire-Pulling Compounds.
22. UL 486A-486B – Wire Connectors.
23. UL 486C – Splicing Wire Connectors.
24. UL 486D – Sealed Wire Connector Systems.
25. UL 493 – Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables.
26. UL 510 – Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
27. UL 719 – Nonmetallic-Sheathed Cables.
28. UL 854 – Service-Entrance Cables.

29. UL 1277 – Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
30. UL 1569 – Metal-Clad Cables.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
 3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 4. Notify Construction Management of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 26 05 00 – Common Work Results for Electrical for submittal procedures.
- B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Wire Pulling Lubricant: Certification of compatibility with conductors/cables.
- D. Field Quality Control Test Reports.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years’ documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer’s instructions.

1.8 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14°F, unless otherwise permitted by manufacturer’s instructions. When installation below this temperature is unavoidable, notify Construction Manager and obtain direction before proceeding with work.

PART 2 – PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
 - 1. Exceptions:
 - a. Use power and control tray cable for installation in cable tray.
- C. Underground feeder and branch-circuit cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. For damp, wet, or corrosive locations as a substitute for NFPA 70, Type NMC nonmetallic-sheathed cable, when nonmetallic-sheathed cable is permitted.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Where exposed to view.
 - b. Where exposed to damage.
- D. Service entrance cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. For overhead service drop, installed in raceway to service head.
 - b. For underground service entrance, installed in raceway.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Where exposed to damage.
- E. Metal-clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet.
 - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
 - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Where not approved for use by the authority having jurisdiction.
 - b. Where exposed to view.

- c. Where exposed to damage.
 - d. For damp, wet, or corrosive locations.
 - e. For isolated ground circuits.
- F. Manufactured wiring systems are permitted only as follows:
- 1. Where not otherwise restricted, may be used:
 - a. For branch circuits where concealed under raised floors, where concealed above accessible ceilings for lighting, and in open ceiling areas for lighting.
 - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Where not approved for use by the authority having jurisdiction.
 - b. Where exposed to view.
 - c. Where exposed to damage.
 - d. For damp, wet, or corrosive locations.
 - e. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide new conductors and cables manufactured not more than one year prior to installation.
- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- E. Comply with NEMA WC 70.
- F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- H. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
- I. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.
- J. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

- K. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- L. Conductor Material:
1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 2. Copper Conductors: Soft drawn annealed, 98% conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 3. Tinned Copper Conductors: Comply with ASTM B33.
 4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- M. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
 2. Control Circuits: 14 AWG.
- N. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- O. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color-coding throughout project.
 2. Color-Coding Method: Integrally colored insulation.
 3. Color Code:
 - a. Equipment Ground, All Systems: Green.

2.3 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
1. Copper Building Wire:

- a. Cerro Wire LLC
 - b. Encore Wire Corporation .
 - c. General Cable Technologies Corporation.
 - d. Service Wire Co
 - e. Southwire Company
 - f. Substitutions: See Division 01.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
- 1. Feeders and Branch Circuits:
 - a. Size 16 AWG and Smaller: Solid.
 - b. Size 14 AWG and Larger: Stranded.
 - 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
- 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground: Type XHHW-2.
- 2.4 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE
- A. Manufacturers:
- 1. Cerro Wire LLC.
 - 2. Encore Wire Corporation.
 - 3. Service Wire Co.
 - 4. Southwire Company.
 - 5. Substitutions: See Division 01.
- B. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.
- C. Provide equipment grounding conductor unless otherwise indicated.
- D. Conductor Stranding:
- 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- E. Insulation Voltage Rating: 600 V.

- F. Cable Jacket: Listed and labeled as sunlight resistant.

2.5 SERVICE ENTRANCE CABLE

- A. Manufacturers:
 - 1. Copper Service Entrance Cable:
 - a. Cerro Wire LLC.
 - b. Encore Wire Corporation.
 - c. Service Wire Co.
 - d. Southwire Company.
 - e. Substitutions: See Division 01.
- B. Service Entrance Cable for Above-Ground Use: NFPA 70, Type SE multiple-conductor cable listed and labeled as complying with UL 854, Style R.
- C. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.
- D. Conductor Stranding: Stranded.
- E. Insulation Voltage Rating: 600 V.

2.6 METAL-CLAD CABLE

- A. Manufacturers:
 - 1. AFC Cable Systems Inc.
 - 2. Encore Wire Corporation .
 - 3. Service Wire Company.
 - 4. Southwire Company
 - 5. Substitutions: See Division 01.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 - 1. Size 16 AWG and Smaller: Solid.
 - 2. Size 14 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Provide oversized neutral conductors where indicated or required.
- G. Provide dedicated neutral conductor for each phase conductor where indicated or required.

- H. Grounding: Full-size integral equipment grounding conductor.
 - 1. Provide additional isolated/insulated grounding conductor where indicated or required.
- I. Armor: Steel, interlocked tape.
- J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.7 POWER AND CONTROL TRAY CABLE

- A. Manufacturers:
 - 1. Encore Wire Corporation
 - 2. General Cable Technologies Corporation
 - 3. Okonite
 - 4. Service Wire Co
 - 5. Southwire Company
 - 6. Substitutions: See Division 01.
- B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.
- C. Where exposed run cable is indicated between cable tray and utilization equipment in qualifying industrial establishments as determined by authorities having jurisdiction, provide tray cable marked as Type TC-ER in accordance with NFPA 70.
- D. Conductor Stranding: Stranded.
- E. Insulation Voltage Rating: 600 V.
- F. Insulation: Type XHHW or XHHW-2.
- G. Grounding: Full-size integral equipment grounding conductor.
- H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.8 MANUFACTURED WIRING SYSTEMS

- A. Manufacturers:
 - 1. AFC Cable Systems Inc.
 - 2. D&P Custom Lights & Wiring Systems, Inc.
 - 3. RELOC Wiring Solutions, a brand of Acuity Brands.
 - 4. Wiremold, a brand of Legrand North America, Inc.
 - 5. Substitutions: See Division 01.
- B. Description: Manufactured wiring assemblies complying with NFPA 70 Article 604, and listed and labeled as complying with UL 183.

- C. Provide components necessary to transition between manufactured wiring system and other wiring methods.
- D. Branch Circuit Cables:
 - 1. Conductor Stranding (Size 10 AWG and Smaller): Solid.
 - 2. Insulation Voltage Rating: 600 V.
 - 3. Insulation: Type THHN.
 - 4. Provide dedicated neutral conductor for each phase conductor where indicated or required.
 - 5. Grounding: Full-size integral equipment grounding conductor.
 - a. Provide additional isolated/insulated grounding conductor where indicated or required.
 - b. Provide redundant grounding, suitable for general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities where indicated or required.
 - 6. Armor: Steel, interlocked tape.
- E. Connectors: Keyed and color-coded to prevent interconnection of different voltages.
- F. Fixture Leads: Type TFN insulation.

2.9 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
 - 3. Connectors for Aluminum Conductors: Use compression connectors.
- D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. Where oversized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 6. Aluminum Conductors: Use compression connectors for all connections.
 7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 8. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221°F for standard applications and 302°F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
 - a. 3M.
 - b. Ideal Industries.
 - c. NSI Industries LLC.
 - d. Substitutions: See Division 01.
- H. Push-in Wire Connectors: Rated 600 V, 221°F.
1. Manufacturers:
 - a. Ideal Industries, Inc.
 - b. NSI Industries LLC.
 - c. Wago Corporation.
 - d. Substitutions: See Division 01.
- I. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
 - a. Burndy LLC.
 - b. IlSCO.
 - c. Thomas & Betts Corporation.

- d. Substitutions: See Division 01.
- J. Compression Connectors: Provide circumferential type or hex type crimp configuration.
 - 1. Manufacturers:
 - a. Burndy LLC.
 - b. IlSCO.
 - c. Thomas & Betts Corporation .
 - d. Substitutions: See Division 01.
- K. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
 - 1. Manufacturers:
 - a. Burndy LLC.
 - b. IlSCO.
 - c. Thomas & Betts Corporation .
 - d. Substitutions: See Division 01.

2.10 ACCESSORIES

- A. Electrical Tape:
 - 1. Manufacturers:
 - a. 3M.
 - b. Plymouth Rubber Europa .
 - c. Substitutions: See Division 01.
 - 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221°F.
 - a. Substitutions: See Division 01.
 - 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0°F and suitable for continuous temperature environment up to 221°F.
 - 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194°F and short-term 266°F overload service.

5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176°F.
 6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221°F.
 7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
1. Manufacturers:
 - a. 3M.
 - b. Burndy LLC.
 - c. Thomas & Betts Corporation.
 - d. Substitutions: See Division 01.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
 - a. Burndy LLC.
 - b. Ideal Industries, Inc.
 - c. IlSCO.
 - d. Substitutions: See Division 01.
- D. Wire Pulling Lubricant:
1. Manufacturers:
 - a. 3M.
 - b. American Polywater Corporation.
 - c. Ideal Industries, Inc.
 - d. Substitutions: See Division 01.
 2. Listed and labeled as complying with UL 267.
 3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 4. Suitable for use at installation temperature.
 5. Products:

- a. American Polywater Corporation; Polywater J Cable Pulling Lubricant.
 - b. American Polywater Corporation; Polywater LZ Cable Pulling Lubricant.
 - c. Substitutions: See Division 01.
- E. Cable Ties: Material and tensile strength rating suitable for application.
- 1. Manufacturers:
 - a. Burndy LLC.
 - b. Substitutions: See Division 01.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- 1. Products:
 - a. Menzies Metal Products; Electrical Roof Stack and Cap.
 - b. Menzies Metal Products; Electrical Retro Box.
 - c. Substitutions: See Division 01.
- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- 1. Products:
 - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built.
 - b. Substitutions: See Division 01.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION**A. Circuiting Requirements:**

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.
 - c. Size raceways, boxes, etc. to accommodate conductors.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
 - a. Provide 200% rated neutral for feeders fed from K-rated transformers.
 - b. Provide 200% rated neutral for feeders serving panelboards with 200% rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- G. Exposed Cable Installation (only where specifically permitted):
1. Route cables parallel or perpendicular to building structural members and surfaces.
 2. Protect cables from physical damage.
- H. Direct Burial Cable Installation:
1. Provide trenching and backfilling in accordance with Section 31 23 16 – Excavation and Section 31 23 23 – Fill.
 2. Install cable with minimum cover of 24 inches unless otherwise indicated or required.
 3. Protect cables from damage in accordance with NFPA 70.
 4. Provide underground warning tape in accordance with Section 26 05 53 along entire cable length.
- I. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- J. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- K. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

- c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.
- L. Install conductors with a minimum of 12 inches of slack at each outlet.
- M. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- N. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- O. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- P. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
 - 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
 - 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- Q. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
 - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
 - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat-shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
 - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

- 3. Wet Locations: Use heat shrink tubing.
 - R. Insulate ends of spare conductors using vinyl insulating electrical tape.
 - S. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
 - T. Identify conductors and cables in accordance with Section 26 05 53.
 - U. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
 - V. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- 3.4 FIELD QUALITY CONTROL
- A. See Section 01 40 00 – Quality Requirements, for additional requirements.
 - B. Inspect and test in accordance with NETA ATS, except Section 4.
 - C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
 - 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
 - D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Ground access wells.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
 - 1. Includes oxide inhibiting compound.
- B. Section 26 05 53 – Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. IEEE 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.
 - 2. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 3. NEMA GR 1 – Grounding Rod Electrodes and Grounding Rod Electrode Couplings.
 - 4. NETA ATS – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
 - 5. NFPA 70 – National Electrical Code.
 - 6. UL 467 – Grounding and Bonding Equipment.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.

3. Notify Construction Manager of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install ground rod electrodes until final backfill and compaction is complete.
- 1.5 SUBMITTALS
- A. See Section 26 05 00 – Common Work Results for Electrical for submittal procedures.
 - B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for grounding and bonding system components.
 - C. Shop Drawings:
 1. Indicate proposed arrangement. Include locations of items to be bonded and methods of connection.
 - D. Field quality control test reports.
 - E. Project Record Documents: Record actual locations of grounding electrode system components and connections.
- 1.6 QUALITY ASSURANCE
- A. Comply with requirements of NFPA 70.
 - B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
 - C. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Receive, inspect, handle, and store products in accordance with manufacturer’s instructions.

PART 2 – PRODUCTS**2.1 GROUNDING AND BONDING REQUIREMENTS**

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Construction Manager. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using “fall-of-potential” method.
- F. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 - 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 - 5. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.

- b. Space electrodes not less than 10 feet from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 - d. Provide ground access well for each electrode.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
 7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: $\frac{1}{4}$ by 2 by 12 inches unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
 - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
 8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.
- G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
 2. Provide equipment grounding conductor routed with supply conductors.
 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.

4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

I. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal air ducts.
8. Provide bonding for metal building frame.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:

1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).

2. Factory Prefabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - a. Exceptions:
 - 1) Use mechanical connectors for connections to electrodes at ground access wells.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 - a. Exceptions:
 - 1) Use exothermic welded connections for connections to metal building frame.
 4. Manufacturers – Mechanical and Compression Connectors:
 - a. allG Fabrication.
 - b. Burndy LLC.
 - c. Harger Lightning & Grounding.
 - d. nVent ERICO.
 - e. Thomas & Betts Corporation.
 - f. Substitutions: See Division 01.
 5. Manufacturers – Exothermic Welded Connections:
 - a. Burndy LLC.
 - b. nVent ERICO; Cadweld.
 - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC.
 - d. Substitutions: See Division 01.
- D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.

3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
 - a. allG Fabrication.
 - b. Harger Lightning & Grounding.
 - c. nVent ERICO.
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC.
 - e. Substitutions: See Division 01.
- E. Ground Rod Electrodes:
 1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: $\frac{3}{4}$ inch diameter by 10 feet length, unless otherwise indicated.
 4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
 5. Manufacturers:
 - a. allG Fabrication.
 - b. Galvan Industries, Inc.
 - c. Harger Lightning & Grounding.
 - d. nVent ERICO.
 - e. Substitutions: See Division 01.
- F. Ground Access Wells:
 1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
 2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
 - a. Round Wells: Not less than 8 inches in diameter.
 - b. Rectangular Wells: Not less than 12 by 12 inches.
 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
 4. Cover: Factory-identified by permanent means with word "GROUND".
 5. Manufacturers:
 - a. allG Fabrication.

- b. Harger Lightning & Grounding.
- c. nVent ERICO.
- d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC.
- e. Substitutions: See Division 01.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45-degree angle or bury horizontally in trench at least 30 inches deep in accordance with NFPA 70 or provide ground plates.
 - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
 - 2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
- D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.
- E. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

- 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
 - F. Identify grounding and bonding system components in accordance with Section 26 05 53.
- 3.3 FIELD QUALITY CONTROL
- A. See Division 01.
 - B. Inspect and test in accordance with NETA ATS except Section 4.
 - C. Perform inspections and tests listed in NETA ATS, Section 7.13.
 - D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
 - F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 – Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 05 50 00 – Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 26 05 33.13 – Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- D. Section 26 05 33.16 – Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- E. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 51 00 – Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 3. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - 4. MFMA-4 – Metal Framing Standards Publication.
 - 5. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 6. NFPA 70 – National Electrical Code.
 - 7. UL 5B – Strut-Type Channel Raceways and Fittings.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
 - 2. Coordinate work to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
 4. Coordinate arrangement of supports with ductwork, piping, equipment, and other potential conflicts.
 5. Notify Construction Manager of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.
- 1.5 SUBMITTALS
- A. See Section 26 05 00 – Common Work Results for Electrical for submittal procedures.
 - B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
 - C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
 - D. Derating Calculations for Fiberglass Channel/Strut Framing Systems: Indicate load ratings adjusted for applicable service conditions.
 - E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications for Powder-Actuated Fasteners: Certified by fastener system manufacturer with current operator’s license.
 - B. Installer Qualifications for Field Welding: See Division 05.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Receive, inspect, handle, and store products in accordance with manufacturer’s instructions.

PART 2 – PRODUCTS**2.1 SUPPORT AND ATTACHMENT COMPONENTS**

- A. General Requirements:
 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. NFPA 70.
 - b. Applicable building code.

- c. Requirements of authorities having jurisdiction.
 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 4. Include consideration for vibration, equipment operation, and shock loads where applicable.
 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 7. Steel Components: Use corrosion-resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Components for Vibration Isolation and/or Seismic Controls: See Section 26 05 48.
- C. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
 1. Manufacturers:
 - a. ABB.
 - b. Eaton Corporation .
 - c. Emerson Electric Co; O-Z/Gedney .
 - d. HoldRite, a brand of Reliance Worldwide Corporation .
 - e. Substitutions: See Section 01 60 00 – Product Requirements.
 2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 3. Conduit Clamps: Bolted type unless otherwise indicated.

4. Products:
 - a. Gripple, Inc; Universal Bracket.
 - b. Gripple, Inc; Fast Trak.
 - c. Gripple, Inc; Universal Clamp (Threaded).
 - d. Gripple, Inc; Low Profile Bracket Kits.
 - e. Substitutions: See Section 01 60 00 – Product Requirements.
- D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
 1. Manufacturers:
 - a. ABB .
 - b. Eaton Corporation.
 - c. Emerson Electric Co; O-Z/Gedney.
 - d. HoldRite, a brand of Reliance Worldwide Corporation.
 - e. Substitutions: See Section 01 60 00 – Product Requirements.
- E. Metal Channel/Strut Framing Systems:
 1. Manufacturers:
 - a. ABB .
 - b. Atkore International Inc; Unistrut.
 - c. Custom Strut and Roll Forming, LLC .
 - d. Eaton Corporation .
 - e. Elgen Manufacturing Company, Inc.
 - f. Substitutions: See Division 01.
 - g. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.
 2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 3. Comply with MFMA-4.
 4. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
 5. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.

6. Minimum Channel Thickness: Steel sheet, 12-gauge, 0.1046 inch.
 7. Minimum Channel Dimensions: 1- $\frac{5}{8}$ inch wide by $\frac{13}{16}$ inch high.
- F. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: $\frac{1}{2}$ -inch diameter.
 - b. Busway Supports: $\frac{1}{2}$ -inch diameter.
 - c. Single Conduit up to 1-inch (27 mm) Trade Size: $\frac{1}{4}$ -inch diameter.
 - d. Single Conduit Larger than 1-inch (27 mm) Trade Size: $\frac{3}{8}$ -inch diameter.
 - e. Trapeze Support for Multiple Conduits: $\frac{3}{8}$ -inch diameter.
 - f. Outlet Boxes: $\frac{1}{4}$ -inch diameter.
 - g. Luminaires: $\frac{1}{4}$ -inch diameter.
- G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
 - a. Atkore International Inc; Unistrut .
 - b. Eaton Corporation .
 - c. Green Link, Inc .
 - d. PHP Systems/Design.
 - e. Substitutions: See Division 01
 2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
 3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- H. Anchors and Fasteners:
1. Manufacturers – Mechanical Anchors:
 - a. Dewalt .
 - b. Hilti, Inc .
 - c. ITW Red Head, a division of Illinois Tool Works, Inc .
 - d. Simpson Strong-Tie Company Inc .

- e. Substitutions: See Section 01 60 00 – Product Requirements.
2. Manufacturers – Powder-Actuated Fastening Systems:
 - a. Dewalt .
 - b. Hilti, Inc .
 - c. ITW Ramset, a division of Illinois Tool Works, Inc .
 - d. Simpson Strong-Tie Company Inc .
 - e. Substitutions: See Division 01.
3. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Hammer-driven anchors and fasteners are not permitted.
13. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
 - b. Comply with MFMA-4.
 - c. Channel Material: Use galvanized steel.
 - d. Minimum Channel Thickness: Steel sheet, 12-gauge, 0.1046 inch minimum base metal thickness.
14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.

- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Construction Manager, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Construction Manager, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Equipment Support and Attachment:
 - 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 - 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches in height; see Division 03 .
 - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.
- J. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.
- K. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.
- L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

- M. Secure fasteners in accordance with manufacturer's recommended torque settings.
 - N. Remove temporary supports.
 - O. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.
- 3.3 FIELD QUALITY CONTROL
- A. See Division 01.
 - B. Inspect support and attachment components for damage and defects.
 - C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
 - D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Requirements for furnishing, installation, and connection of electrical conduits, wireways, pull boxes, and fittings. Raceways shall be provided for all wiring unless shown or specified otherwise.
- B. Refer to Section 26 05 00 – Common Work Results for Electrical for quality assurance, submittal procedures, and other requirements.

1.2 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ANSI C80.1 – American National Standard for Electrical Rigid Steel Conduit (ERSC).
 - 2. ANSI C80.5 – American National Standard for Electrical Rigid Metal Conduit – Aluminum (ERMC-A).
 - 3. FS A-A-50563B – COMMERCIAL ITEM DESCRIPTION, CONDUIT OUTLET BOXES, BODIES, AND ENTRANCE CAPS, ELECTRICAL: CAST METAL (10-SEP-2013) [SUPERSEDING W-C-586D].
 - 4. FS WW-C-540A – FEDERAL SPECIFICATION: CONDUIT, METAL, RIGID, (ELECTRICAL, ALUMINUM).
 - 5. NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
 - 6. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit.
 - 7. NFPA 70 – National Electrical Code.
 - 8. NMTBA JIC EMP-1 – Electrical Standard for Mass Production Engineering.
 - 9. UL 1 – Flexible Metal Conduit.
 - 10. UL 6 – Electrical Rigid Metal Conduit-Steel.
 - 11. UL 6A – Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel.
 - 12. UL 360 – Liquid-Tight Flexible Metal Conduit.
 - 13. UL 514B – Conduit, Tubing, and Cable Fittings.
 - 14. UL 651 – Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.

1.3 SUBMITTALS

- A. See Section 26 05 00 – Common Work Results for Electrical for submittal procedures.

- B. Submit catalog cut sheets.

1.4 DEFINITIONS AND ACRONYMS

- A. Conduit/Raceway/Pathway: “Conduit”, “raceway”, “pathway” and similar terms shall be taken to mean “conduit” unless specifically indicated otherwise in project manual documents, or unless specifically directed otherwise in field by Owner or Design Professionals. All such terms shall be considered synonymous for the general purposes of installation means and methods.
- B. FLEX: Flexible steel conduit.
- C. GRS: Rigid steel conduit.
- D. LFS: Liquidtight flexible steel conduit.
- E. PRS: PVC coated rigid steel conduit.
- F. PVC80: Schedule 80 PVC conduit.
- G. RAC: Rigid Aluminum Conduit.
- H. RMC: Rigid Metal Conduit.
- I. SS: Rigid stainless-steel conduit.
- J. WW: Wireway and auxiliary gutter.

PART 2 – PRODUCTS

2.1 RACEWAY SPECIFICATIONS

- A. Raceway Identification: Flex
 1. Description: Flexible steel conduit.
 2. Application: Final connection to lighting fixtures in architecturally finished areas only.
 3. Compliance: UL 1.
 4. Construction: Spirally-wound galvanized steel strip with successive convolutions securely interlocked.
 5. Minimum Size: ½-inch.
 6. Fittings: Compression type.
 7. Other: FLEX shall be provided with an internal ground wire.
 8. Installation: Flexible steel conduit shall be made up tight and with conductive “CopperShield” thread compound.
- B. Raceway Identification: GRS
 1. Description: Rigid steel conduit.
 2. Compliance: ANSI C80.1 and UL 6.
 3. Finish: Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.

4. Manufacturers: Allied Tube and Conduit Corp., Wheatland Tube Co., or approved equal.
5. Minimum Size: Unless otherwise specified, ¾-inch for exposed, 1-inch for embedded, encased, or otherwise inaccessible.
6. Fittings: Hubs: Insulated throat with bonding locknut, hot-dip galvanized. The hubs shall utilize a neoprene O-ring and shall provide a watertight connection. O-Z Gedney, CHM-XXT, or approved equal.
7. Unions: Electrogalvanized ferrous alloy type Appleton UNF or UNY, Crouse Hinds UNF or UNY, or approved equal. Threadless fittings are not acceptable.
8. Boxes:
 - a. Indoor: Type FD cast ferrous for all device boxes and for junction boxes less than 6-inches square. NEMA 12 welded steel 6-inches square and larger. Door shall have hinges with clamp locks. Boxes in process areas shall be NEMA 4 watertight.
 - 1) Conduit Bodies: Ferrous alloy type with screw taps for fastening covers. Gaskets shall be made of neoprene.
 - b. Outdoor: Type FD cast ferrous for all devices and for junction boxes less than 6-inches square. NEMA 4X stainless steel for 6-inches square and larger.
9. Corrosive: NEMA 4X stainless steel.
10. Hazardous: NEMA Class 7 cast ferrous.
11. Elbows:
 - a. ¾-through 1½ Inches: Factory-fabricated or field bent.
 - b. 2 through 6 Inches: Factory-fabricated only.
12. Conduit Bodies:
 - a. ¾-inch through 4 Inches: Malleable iron, hot-dip galvanized, unless otherwise noted. Neoprene gaskets for all access plates. Tapered threads for all conduit entrances.
 - b. 5 Inches and 6 Inches: Electrogalvanized iron or cast-iron box.
13. Expansion Fittings: Expansion fittings in embedded runs shall be watertight and shall be provided with an internal bonding jumper. The expansion material shall be neoprene and shall allow for ¾-inch movement in any direction.
 - a. Manufacturers: Appleton, Crouse-Hinds, Hubbell, O.Z. Gedney, or approved equal.

14. Installation:
 - a. Rigid steel conduit shall be made up tight and with conductive "CopperShield" thread compound. Joints shall be made with standard couplings or threaded unions. Steel conduit shall be supported away from the structures using hot dip galvanized malleable iron straps with nesting backs.
 - b. Conduit entering boxes shall be terminated with a threaded hub with a grounding bushing.
 - c. Exposed male threads or rigid steel conduit shall be coated with zinc-rich paint.
- C. Raceway Identification: LFS
 1. Description: Liquidtight flexible steel conduit.
 2. Application: Final connection to equipment subject to vibration or adjustment.
 3. Compliance: UL 360.
 4. Construction: Spirally-wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight plastic cover.
 5. Minimum Size: $\frac{3}{4}$ -inch.
 6. Fittings:
 - a. General: Watertight, outdoor, and wet rated. Grounding ferrule shall be threaded to engage conduit spiral. Provide O-ring seals around the conduit and box connection and insulated throat. 45° and 90° fittings shall be used where applicable.
 - b. Dry Locations: Material: Cadmium-plated malleable iron body and gland nut with cast-in lug, brass.
 - c. Wet, Outdoor, or Corrosive Locations: Material: Stainless steel.
 7. Installation:
 - a. The length of flexible liquidtight conduit shall not exceed 15 times the trade diameter of the conduit. The length of liquidtight conduit shall not exceed 36 inches.
 - b. Liquidtight flexible steel conduit shall be made up tight and with conductive "CopperShield" thread compound.
- D. Raceway Identification: PRS
 1. Description: Rigid steel conduit, corrosion-resistant, polyvinyl chloride (PVC) coated.
 2. Compliance: ANSI C80.1, UL 6, NEMA RN1.

3. Finish: PRS shall be hot-dipped galvanized rigid steel conduit. The inside and outside, as well as the threads shall be galvanized. A minimum 40-mil thick PVC coating shall be bonded to the outside of the conduit and the inside shall be coated with 2-mil urethane. Coating shall be free of pinholes. Bending of conduit shall not damage either the interior or exterior coating. Bond strength shall exceed the tensile strength of the PVC coat. Elbows shall be factory made and coated.
 4. Minimum Size: $\frac{3}{4}$ -inch.
 5. Fittings: Similarly coated to the same thickness as the conduit and provided with Type 316 stainless steel hardware. A 2-mil urethane coating shall be applied to the interior, and the threads of all fittings and couplings. Conduit and fittings shall be manufactured by the same company.
 6. Hubs: Hubs for connection of conduit to junction, device, pull, or terminal boxes shall be threaded and made of cast ferrous alloy. Hubs shall be galvanized steel and have insulating bushings. The hubs shall utilize a neoprene O-ring and shall provide a watertight connection.
 7. Boxes:
 - a. Nonhazardous: NEMA 250, Type 4X stainless steel.
 - b. Hazardous: NEMA 250, Type 7D cast ferrous.
 8. Installation: PVC-coated conduit shall be supported away from the structure using PVC-coated conduit wall hangers. All conduit threads shall be covered by a plastic overlap which shall be coated and sealed per manufacturer's recommendations. Plastic coated conduit shall be made tight with special wrenches and fittings designed for tightening PVC-coated conduit. All threads shall be protected against corrosion per NFPA 70 §300.6 (a) by liberally applying an approved electrically conductive, corrosion-resistant compound – "CopperShield". Pipe wrenches and channel locks shall not be used for tightening plastic-coated conduits. Damaged areas, including threads, shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable.
- E. Raceway Identification: PVC40
1. Description: Rigid nonmetallic polyvinylchloride conduit for normal duty applications including direct burial.
 2. Compliance: NEMA TC 2 and UL 651.
 3. Construction: Schedule 40, polyvinylchloride (PVC).
 4. Minimum Size: $\frac{3}{4}$ -inch exposed; 1 inch embedded or encased.
 5. Fittings: PVC solvent weld type.

6. Boxes:
 - a. Indoor: NEMA Class 4, nonmetallic.
 - b. Outdoor and Corrosive: NEMA Class 4X, nonmetallic.
 7. Installation:
 - a. Exposed PVC conduit shall be run on supports spaced not more than 3 feet apart for conduits up to 1 inch 5 feet apart for conduits 1¼-inches to 2 inches and 6 feet apart for conduits 2½ inches and larger. PVC conduit shall not be provided where it will be damaged by heat.
 - b. PVC conduit shall have bell ends where terminated at walls.
- F. Raceway Identification: PVC80
1. Description: Rigid nonmetallic conduit, extra heavy wall thickness for all locations including direct bury under roadways and where exposed to physical damage.
 2. Compliance: NEMA TC 2, UL 651.
 3. Construction: Schedule 80, high-impact, polyvinylchloride (PVC).
 4. Minimum Size: ¾-inch exposed; 1-inch embedded or encased.
 5. Fittings: PVC solvent weld type.
 6. Boxes:
 - a. Indoor: NEMA Class 4, nonmetallic.
 - b. Outdoor and Corrosive: NEMA Class 4X, nonmetallic.
 7. Installation: Exposed PVC conduit shall be run on supports spaced not more than 3 feet apart for conduits up to 1 inch 5 feet apart for conduits 1¼-inches to 2 inches and 6 feet apart for conduits 2½ inches and larger. PVC conduit shall not be provided where it will be damaged by heat.
 8. PVC conduit shall have bell ends where terminated at walls.
- G. Raceway Identification: RAC
1. Conduit Description: Rigid Aluminum Conduit manufactured from 6063 alloy with T 1 temper.
 2. Finish: Corrosion-resistant aluminum.
 3. Compliance: UL 6A, ANSI C80.5 and FS WW-C-540A.
 4. Construction: Corrosion-resistant aluminum
 5. Manufacturer: Allied Tube and Conduit Corp., Wheatland Tube Co., or approved equal.
 6. Minimum Size: Unless otherwise specified, ¾-inch for exposed, 1-inch for embedded, encased, or otherwise inaccessible.

7. Elbows:
 - a. ¾ through 1-Inch: Factory-fabricated or field bent with approved bender.
 - b. 1½ through 4-Inch: Factory-fabricated only.
8. Fittings:
 - a. Conduit Bodies:
 - 1) Material/Finish: Cast copper-free aluminum.
 - 2) Size: ¾-inch through 4 inch.
 - 3) Cover: Stamped, domed top, copper-free aluminum with neoprene gasket. Stainless steel screws. Conduit body with gasketed cover shall be outdoor, raintight, wet location rated.
 - 4) Compliance: UL 514B, FS A-A-50563B, and NEMA FB 1.
 - b. Hubs: Watertight, gasketed, copper-free aluminum, insulated throat with ground screw.
 - c. Unions: copper-free aluminum type Appleton UNF or UNY, Crouse Hinds UNF or UNY, or approved equal. Threadless fittings are not acceptable.
 - d. Conduit Seals: Copper-free aluminum, Type EYSX.
 - e. Manufacturers: Crouse-Hinds, O.Z. Gedney, or approved equal.
9. Boxes:
 - a. Indoor/Dry Locations: Locations which are both indoor and dry.
 - 1) Less than 6 inches square: Type FD copper-free aluminum for all device boxes. Copper-free aluminum covers with stainless steel screws. Gasketed, watertight, wet-rated for process areas.
 - 2) 6 Inches Square and Larger:
 - i. NEMA 12 rated, welded copper-free aluminum with hinged door and clamp lock.
 - ii. Boxes within process areas shall be NEMA 4 welded copper-free aluminum.
 - b. Outdoor Locations:
 - 1) Less than 6 inches square: Type FD copper-free aluminum for all device boxes. Copper-free aluminum covers with stainless steel screws. Gasketed, watertight, wet-rated.
 - 2) sq. and larger: NEMA 4 rated, welded copper-free aluminum with hinged door and clamp lock.

- c. Manufacturers: Crouse-Hinds, O.Z. Gedney, or approved equal.
 10. Hazardous Areas: Copper-free aluminum, NEMA 7, Explosion-proof, raintight and wet location rated.
 11. Installation:
 - a. Aluminum conduit shall be made up tight and with approved, conductive aluminum antioxidant joint compound. Joints shall be made with standard couplings or threaded unions. Where not shown on Drawings, support RAC and associated components using stainless steel supports which include a non-conductive barrier between the stainless steel and the aluminum to prevent galvanic corrosion.
 - b. Conduit entering boxes shall be terminated with a threaded hub with a grounding bushing.
 - c. Aluminum conduit is not to be installed in concrete or soil unless shown on the Drawings. For aluminum conduit that is installed in concrete or in contact with soil, supplementary corrosion protection, such as paints or wraps approved for the purpose, is required.
- H. Raceway Identification: SS
 1. Description: Rigid stainless-steel conduit.
 2. Compliance: ANSI C80.1 and UL 6 .
 3. Material: 316 stainless steel.
 4. Manufacturers: Calbrite or approved equal.
 5. Minimum Size: Unless otherwise specified, $\frac{3}{4}$ inch for exposed, 1 inch for embedded, encased, or otherwise inaccessible.
 6. Fittings: Hubs: bonding locknut, 316 stainless steel. The hubs shall utilize a neoprene O-ring and shall provide a watertight connection.
 7. Unions: 316 stainless steel. Threadless fittings are not acceptable.
 8. Boxes:
 - a. Indoor:
 - 1) Type FD cast 316 stainless steel for all device boxes and for junction boxes less than 6-inches square. NEMA 12 welded steel 6-inches square and larger. Door shall have hinges with clamp locks. Boxes in process areas shall be NEMA 4X watertight.
 - 2) Conduit Bodies: 316 stainless steel type with screw taps for fastening covers. Gaskets shall be made of neoprene.

- b. Outdoor: Type FD cast 316 stainless steel for all devices and for junction boxes less than 6-inches square. NEMA 4X stainless steel for 6-inches square and larger.
9. Corrosive: NEMA 4X stainless steel.
10. Hazardous: NEMA Class 7 cast 316 stainless steel.
11. Elbows:
 - a. ¾-Inch through 1½ Inches: Factory fabricated or field bent.
 - b. 2-Inches through 6-Inches: Factory fabricated only.
12. Conduit Bodies:
 - a. ¾ Inch through 4 Inches: 316 stainless steel. Neoprene gaskets for all access plates. Tapered threads for all conduit entrances.
13. Expansion Fittings: Expansion fittings in embedded runs shall be watertight and shall be provided with an internal bonding jumper. The expansion material shall be neoprene and shall allow for ¾-inch movement in any direction.
14. Installation:
 - a. Rigid stainless-steel conduit shall be made up tight and with conductive "CopperShield" thread compound. Joints shall be made with standard couplings or threaded unions. Rigid stainless-steel conduit shall be supported away from the structures using hot dip galvanized malleable iron straps with nesting backs.
 - b. Conduit entering boxes shall be terminated with a threaded hub with a grounding bushing.
 - c. Galvanic isolation.
- I. Raceway Identification: WW
 1. Description: Wireway and auxiliary gutter, flanged, oiltight type with hinged covers.
 2. Compliance: NMTBA JIC EMP-1NMTBA JIC EMP-1.
 3. Minimum Size: 8-inches by 8-inches.
 4. Finish: Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces. Paint with factory standard finish.
 5. Application: As indicated on the Drawings.

2.2 BOXES AND FITTINGS

- A. Junction Boxes, Pull Boxes, and Wiring Gutters:
 1. Indoor:

- a. Type FD cast ferrous for all device boxes and for junction boxes less than 6-inches square. NEMA 12 welded steel 6-inches square and larger. Door shall have hinges with clamp locks. Boxes in process areas shall be NEMA 4 watertight.
 - b. Conduit Bodies: Ferrous alloy type with screw taps for fastening covers. Gaskets shall be made of neoprene.
2. Outdoor:
 - a. Type FD cast ferrous for all devices and for junction boxes less than 6-inches square. NEMA 4X stainless steel for 6-inches square and larger.
 3. Outdoor boxes and enclosures shall be provided with neoprene gaskets on the hinged doors or removable covers.
 4. Boxes and enclosures in indoor corrosive areas shall be NEMA 4X stainless steel or nonmetallic.
 5. Boxes in classified areas shall be NEMA Class 7 galvanized cast ferrous.
 6. Box and gutter sizes, metal thickness, and grounding shall comply with the National Electrical Code.
 7. Bolt-on junction box covers 3 feet square or larger, or heavier than 25 pounds, shall have a rigid handle.
 8. Covers larger than 3 by 4 feet shall be split.
- B. Conduit Seals:
1. Conduit seals shall be explosion-proof with a minimum 40% wire fill capacity of the EYSX type. Where shown on Drawings, use retrofit conduit sealing fittings of the EYSR type.
 2. Install conduit seals for use in classified areas as shown on Drawings or where any conduit leaves the classified space.
 3. Use PVC-coated fittings with urethane interior coating for PVC-coated GRS; use copper free cast aluminum for rigid aluminum.
 4. The sealing compound shall be as prescribed by the manufacturer of the sealing conduit body.
 5. Use the sealant, such as Chico, in areas that are defined as hazardous and meet the NFPA 70 requirements for Article 500.
- 2.3 UNDERGROUND MARKING TAPE
- A. Six-inch-wide, detectable, metallic-lined tape with red polyethylene film on top and clear polyethylene film on the bottom.
 - B. Tape legend shall be clearly printed with black over red tape and shall read "CAUTION ELECTRIC LINE BURIED BELOW".
 - C. Use for early warning protection of underground raceways.

- D. Manufacturers: Brady "Identoline", Services and Materials "Buried Underground Tape", Somerset (Thomas & Betts) "Protect-A-Line" or approved equal.

2.4 FIRESTOPS

- A. Apply in accordance with manufacturer's recommendations.
- B. Manufacturers: Flamemastic 77, Vimasco No. 1-A, or approved equal.
- C. Products which are affected by water are not acceptable.

PART 3 – EXECUTION

LOCATION	APPLICATION/CONDITION	RACEWAY IDENTIFIER
Indoor Noncorrosive	Exposed	GRS, SS
Indoor Corrosive	Exposed; Includes Wet Well Location	PRS, SS
Outdoor	Exposed	PRS, SS
Concealed	Embedded in Concrete Structure or Beneath Slab-On-Grade	PVC80
Underground	Instrumentation, Communications, and Data Signals Encased in Concrete, Duct Bank	PRS, PVC80
Underground	Instrumentation, Communications, and Data Signals Directly Buried	PRS, PVC80
Underground	Power and Control Directly Buried	PVC80
Underground	Power and Control Encased in Concrete, Duct Bank	PVC40
Nonhazardous	Final Connection to Equipment And Light Fixtures	LFS
Underground	Telephone Service Direct Buried	PVC80
ARCHITECTURALLY Finished Areas	Final Connection to Light Fixtures	FLEX
Transition	Above-Grade to/from Below-Grade	PRS

3.1 CONDUIT

- A. General:
- The number of directional changes of a conduit shall be limited to 270° in any run between pull boxes.
 - Conduit runs shall be limited to a maximum of 400 feet, less 100 feet or fraction thereof, for every 90° of change in direction.

3. Provide conduit and raceway systems that are electrically continuous per electrical code requirements or provide additional ground conductors as required by the electrical code.
- B. Indoor and Outdoor Conduit Systems:
1. Unless otherwise indicated, in general, conduit inside structures shall be exposed.
 2. Unless otherwise indicated, the Contractor shall be responsible for determining conduit routing that conforms to the installation requirements set forth herein.
 3. Install conduit to conform to the requirements of Part 2 and the following:
 - a. Install exposed conduit either parallel or perpendicular to structural members and surfaces.
 - b. Two or more exposed conduits in the same general routing shall be in parallel with symmetrical bends.
 - c. Exposed conduit shall be run on supports spaced not more than 10 feet apart.
 - d. Where three or more conduits are located in parallel run, space them out from the wall using framing channel.
 - e. Where conduits are suspended from the ceiling, support systems shall comply with the requirements of Section 26 05 29 – Hangers and Supports for Electrical Systems.
 - f. Secure conduit rack supports to concrete walls and ceilings by means of cast in place anchors or framing channel concrete inserts.
 - g. Conduits shall be at least 6 inches from high temperature piping, ducts, and flues with temperatures higher than 90°C.
 - h. Install conduits between the reinforcing steel in walls or slabs which have reinforcing in both faces. In slabs which have only a single layer of reinforcing steel, place conduits under the reinforcement.
 - i. Route conduit clear of structural openings and indicate future openings.
 - j. Flash and seal watertight those conduits which pass through roofs or metal walls.
 - k. Neatly group conduit into any openings cut into concrete and masonry structures, and grout using non-shrink type grout.
 - l. During construction, cap conduits to prevent entrance of dirt, trash, and water.
 - m. Terminate exposed conduit stubs for future use with galvanized pipe caps.

- n. Determine concealed conduit stub-up locations from the manufacturer's Shop Drawings.
 - o. Terminate concealed conduit for future use in equipment or by galvanized couplings plugged flush with structural surfaces.
 - p. Where the Drawings indicate future duplication of equipment wired hereunder, provide concealed portions of conduits for future equipment.
 - q. Conduit installed horizontally shall allow headroom of at least 7 feet except where it may be installed along structures, piping, and equipment, or in other areas where headroom cannot be maintained because of other considerations.
 - r. Terminate all conduits that enter enclosures by fittings that ensure that the NEMA rating of the enclosure is not affected or changed.
 - s. Transitions from concealed or underground or embedded locations to exposed or above-grade locations shall be made using PVC-coated rigid steel conduit for a distance of at least 12 inches on either side of transition. Connect underground metallic or nonmetallic conduit that turns out of concrete, masonry, or earth to a 90° elbow of PVC-coated rigid steel conduit before emergence.
 - t. Conduit across structural joints where structural movement is allowed shall have an OZ Gedney "Type DX", Crouse-Hinds "Type XD", or approved equal, bonded, weathertight expansion and deflection fitting of that conduit size.
 - u. Treat cut surfaces or damaged ends with corrosion-resistant coatings, such as "Devcon Z" prepared by Subox Coatings, "Galvanox Type I" prepared by Pedley Knowles, or approved equal. Application shall follow manufacturer's recommendation.
 - v. At all boxes and equipment, provide insulated-type metallic grounding bushings for metallic conduits. Bond together all conduits to provide continuity of the equipment grounding system. Size bonding conductor per NEC.
 - w. Clean, cap/plug, and provide all spare raceways with a nylon pull rope.
- C. Underground Conduit Systems:
- 1. All excavation, backfilling, and concrete work shall conform to respective sections of these Specifications. Underground conduit shall conform to the following requirements:
 - a. Exposed outdoor conduit risers shall continue to 3 inches above grade, with top crowned and edges chamfered.

- b. Unless otherwise indicated, underground conduits and conduit banks shall have 2 feet minimum earth cover.
 - c. Using a special rubber gasketed sleeve and joint assemblies, or with sleeves and modular rubber sealing elements, seal watertight those conduits not encased in concrete and passing through walls that have one side in contact with earth.
 - d. Immediately upon completion of pouring concrete, thoroughly swab conduits on the inside. After the concrete has set, and before backfilling, pull a mandrel, having a diameter equal to the nominal conduit inside diameter minus ½-inch, and not less than 4 inches long, through each conduit. If the mandrel showed signs of protrusions on the inside of the conduit, repair or replace the conduit.
 - e. Clean, cap/plug, and provide all spare raceways with a nylon pull rope.
2. Provide detectable underground marking tape placed 6 to 12 inches below finished grade and directly above the conduit.
 3. Transition from Underground to Above Grade: Provide PRS conduit sweep and PRS conduit riser to a distance of at least 12 inches above grade.
 4. Underground sweeps shall be PRS unless otherwise noted on the Drawings.
 5. Unless otherwise indicated, use 6-inch coarse sand backfill on all sides of underground conduit.
- D. Existing Conduit Systems:
1. Where existing conduit raceways are utilized:
 - a. Blow out the conduit using compressed air to remove foreign material and water. Pull wire brush through conduit and blow out the conduit a second time using compressed air.
 - b. Pull a test mandrel having a diameter equal to the nominal conduit inside diameter minus ½-inch, and not less than 4 inches long, through each spare conduit. If the mandrel showed signs of protrusions on the inside of the conduit, repair or replace the conduit. Notify the Construction Management/ Engineer if the existing conduit cannot be utilized.
 - c. Clean up conduit threads at exposed conduit ends using a wire brush.
 - d. Treat minor surface rust with a cleaning agent and apply zinc, rust inhibiting coating to the damaged area.

END OF SECTION 26 05 33

SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
- B. Handholes and boxes.

1.2 RELATED REQUIREMENTS

- A. Division 01 Specifications

1.3 DEFINITIONS

- A. Duct: an underground raceway. This term may be used interchangeably with the term raceway.
- B. Duct Bank: two or more raceways grouped together, irrespective of duct material or encasement material.
- C. ENT: Electrical Non-Metallic Tubing
- D. EPC: Electrical Polyvinyl Chloride (PVC) Conduit
- E. RMC: Rigid metal conduit.
- F. RNC: Rigid nonmetallic conduit.
- G. RSC: Rigid Steel conduit.

1.4 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. AASHTO HB – Standard Specifications for Highway Bridges.
 - 2. ACI 318 – Building Code Requirements for Structural Concrete.
 - 3. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 4. ASTM C33/C33M – Standard Specification for Concrete Aggregates.
 - 5. ASTM C150/C150M – Standard Specification for Portland Cement.
 - 6. ASTM C858 – Standard Specification for Underground Precast Concrete Utility Structures.
 - 7. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 8. NFPA 70 – National Electrical Code.

1.5 SUBMITTALS

- A. See Section 26 05 00 – Common Work Results for Electrical for submittal procedures.
- B. Product Data: Provide product data for the following:
 - 1. Duct-bank materials, including separators and miscellaneous components.
 - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - 3. Accessories for handholes, boxes, and other utility structures.
 - 4. Warning tape.
- C. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans and elevations with dimensions and weights. Include sections, details, attachments to other work, and accessories, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Reinforcement details.
 - 3. Frame and cover design.
 - 4. Ladder details.
 - 5. Grounding details.
 - 6. Joint details.
- D. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Cover design.
 - 3. Grounding details.
 - 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
- E. Other Shop Drawings and Product Data:
- F. Project Record Documents: Record actual routing of duct bank and submit in accordance with Division 01.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section and according to ASTM E329.
- B. Comply with IEEE C2.
- C. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Protect conduit from corrosion and entrance of debris by storing above grade with an appropriate covering. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

PART 2 – PRODUCTS**2.1 GENERAL**

- A. Materials and equipment shall conform to the respective specifications and standards and to the Specifications herein. Electrical ratings shall be as indicated.
- B. Conduit: Provide per Division 26.
- C. Wire and Cable: Provide per Division 26.

2.2 HANDHOLES

- A. Provide handholes of reinforced precast concrete, or injection molded composite plastic material. Handholes shall include a base, a body, extensions, and a cover. Handholes with a perimeter of 10 feet or more (e.g., 3 feet by 2 feet) shall have both pulling irons and cable racks. All hardware shall be stainless steel, or hot-dip galvanized after fabrication; cable racking hardware, however, shall be non-metallic and corrosion resistant. If no handhole size is shown on the Drawings, size units per NFPA 70 or provide 12 inches by 24 inches by 18 inches deep, whichever is larger. Structure shall be fabricated in accordance with ACI 318 .
- B. Aggregate used in pre-cast handholes shall conform to the specifications given in ASTM C33/C33M.
- C. Cement used shall be Type 11, low alkali Portland cement and shall meet ASTM C150/C150M, Type 11.
- D. Reinforcing bars shall be intermediate grade billet steel conforming to ASTM A615/A615M .
- E. Design wheel loads for handhole covers shall be HS 20-44 as given in AASHTO HB.

2.3 PRECAST UTILITY ACCESS HOLES

- A. Comply with ASTM C858 for design and manufacturing processes.

- B. Duct entrances and windows shall be located near the corners of structures to facilitate cable racking.
- C. Provide all necessary lugs, rabbets, and brackets. Set pulling-in iron shall be installed in the wall opposite each duct line entrance. The word "ELECTRICAL" shall be cast in the top face of all utility access hole covers. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable. Cable racking hardware shall be non-metallic and corrosion resistant as manufactured by Pacific Utilities Supply, or equal.
- D. Metal Frames, Covers: Provide steel or malleable iron frames, and covers conforming to Federal Specification RR-G-661, Type I.
- E. Complete utility access hole shall be rated for HS 20-44 wheel loading as given in AASHTO HB.

PART 3 – EXECUTION

3.1 COORDINATION

- A. Coordinate layout and installation of ducts, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Verify field measurements, routing and termination locations of duct bank prior to excavation for rough-in. Coordinate duct bank installation with underground Work and site Work and other site improvement Work specified in other Divisions.
- B. Coordinate elevations of ducts and duct-bank entrances into handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Duct bank routing as indicated on the Drawings is the approximate location. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to handholes, and as approved by Construction Management / Engineer.
- C. Interruption of Existing Electrical Service: Comply with the requirements of Section 26 00 05 "Common Work Results for Electrical."

3.2 UNDERGROUND RACEWAYS WITH CONCRETE ENCASEMENT

- A. All underground road crossing raceways shall be encased in concrete unless existing conduits are used.
 - 1. Concrete encasement shall be minimum of 3 inches around outer walls of raceways and minimum of 2 inches between raceways. Conduits shall be PVC-40 OR [Type EB as indicated on the Drawings].
 - 2. Concrete shall be Portland Cement type with 4 sacks cement per cubic yard of concrete, maximum coarse aggregate size of 3/8-inches and shall have minimum strength of 2,000 psi after 28 days. Amount of water shall not exceed slump required for placement. Five pounds red lead oxide shall

- be added per cubic yard of concrete for medium voltage raceway encasement only.
3. Underground raceways shall slope toward utility access holes, pullboxes, etc., at minimum rate of 3 inches per 100 feet unless indicated otherwise on Drawings. Raceway entrances in utility access holes, handholes, etc., shall be by means of bell ends and shall be sealed against entry of silt, debris, rodents, etc., into raceways.
 4. Top of concrete encasement shall be minimum of 24 inches below grade.
 5. Minimum radius of all horizontal bends in underground duct banks shall be 12 times nominal conduit size. Bends shall be formed of factory-made sweeps or continuous assembly of bend segments or curved segments, except that PVC-40 conduits may be field formed. Minimum radius of all vertical bends in underground raceways shall be twelve times nominal size of conduit.
 6. Underground raceways within roadways shall be run parallel or perpendicular to road centerline.
 7. Pull wires left in underground raceways shall be 1/8-inch nylon rope or 3/16-inch polypropylene.
 8. Terminate conduits in end-bells where duct lines enter utility access holes and handholes. Provide structural support for concrete encased duct banks at the point where they terminate. Separators shall be of precast concrete, high impact polystyrene, steel, or any combination of these. Stagger the joints of the conduits by rows and layers so as to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand and dirt by means of suitable conduit plugs. As each section of a duct line is completed, draw a brush through having the diameter of the duct, and having stiff bristles until the conduit is clear of all particles of earth, sand, and gravel; then immediately install conduit plugs.
 9. Construct underground raceway systems (whether single raceways, or multiple raceway banks) utilizing snap together plastic "chairs" spaced and staked to the trench floor, no more than 6 feet apart along the entire length of the trench to maintain the specified minimum encasement between raceways, and between the duct bank and trench walls and floor. Provide Carlon Snap-N-Stac, or equal.
- B. Connections to Existing Ducts: Where connections to existing duct lines are indicated, excavate the lines to the maximum depth necessary. Cut off the lines and remove loose concrete from the conduits before new concrete encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct line, to take the shear at the joint of the duct lines. Remove existing cables that constitute interference with the work. Abandon in place those used ducts and cables that do not interfere with the work.

- C. Removal of Ducts: Where duct lines are removed from existing utility access holes, close the openings to waterproof the utility access hole. Chip out the wall opening to provide a key for the new section of wall.
- D. See Section 25 05 43 for additional requirements.

3.3 UNDERGROUND RACEWAYS WITHOUT CONCRETE ENCASEMENT

- A. Provide raceways without concrete encasement only if specifically shown on the Drawings; otherwise, provide concrete encasement as above.
- B. Provide sand backfill three inches all around the raceway.
- C. Construct raceways per the applicable provisions above for underground raceways with concrete encasement.

3.4 UTILITY ACCESS HOLES AND HANDHOLES

- A. Install and test in accordance with the requirements of Section 02085.
- B. Provide utility access holes and handholes complete with all accessories, as indicated. Identify each casting by having the manufacturer's name and address cast into an interior face or permanently attached thereto.
- C. Utility Access Hole, Handhole or Concrete Pullbox Grounding: Ground rods installed in electrical distribution system handholes or concrete pullboxes shall be properly connected to the cable shielding, metallic sheath, and armor at each cable joint or splice by means of No. 4 AWG or equivalent braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Ground wires shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Ground wires shall be neatly and firmly attached to handhole walls and the amount of exposed bare wire shall be held to a minimum.
- D. Installation of Cable in Utility access holes and Handholes: Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form all cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators at a maximum of 18 inches. In existing handholes and vaults where new ducts are to be terminated or where new cables are to be installed, provide cable supports and grounding as required for a neat and workmanlike installation with all cables properly arranged and supported. Support cable splices in underground structures by racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure. Provide additional cable racks in each existing underground structure through which new cable is run.

- E. Fireproofing (Arc Proofing) of Cables in Utility access holes, Handholes and Vaults: All wire and cables which will carry current at 2,200 volts or more in utility access holes, handholes, and vaults shall be fireproofed.
1. Arc-proofing Test for Cable Fireproofing Materials: Test one sample assembly consisting of a 3-inch diameter lead tube with a ¼-inch wall thickness, fireproofed as specified. Make tests at three different points. At each point the testing shall consist of an arc magnetically blown against the test assembly until melting occurs at the point of arc contact. The arc shall be struck between two 5/8-inch electrodes located one inch from the sample assembly. Electrodes must be electrodes located one inch from the sample assembly. Electrodes must be squared off after each test run. Arc current shall be between 195 and 210 amperes at 40 vdc. For each test the fireproofing shall prevent damage to the lead for at least 25 seconds at any point and an average time of no less than 30 seconds for the test. In lieu of the above test, the Contractor may submit copies of the report of such a test previously made for the manufacturer, with certification that the material supplied for this project is the same as that used in the test. Test elements and requirements shall be essentially as specified in the test above.
 2. Fireproofing Tape: Strips of fireproofing tape approximately 1/16-inch thick by 3 inches wide shall be wrapped tightly around each cable spirally in half-lapped wrapping, or in two butt-joined wrappings with the second wrapping covering the joints in the first. The tape shall be applied with the coated side toward the cable and shall extend one inch into the ducts. To prevent unraveling, the fireproofing tape shall be random wrapped the entire length of the fireproofing with pressure sensitive glass cloth tape. The fireproofing tape shall consist of a flexible, conformable fabric having one side coated with flame retardant, flexible, polymeric coating and/or a chlorinated elastomer not less than 0.050-inch thick and shall weigh not less than 2.5 pounds per square yard. The tape shall be noncorrosive to cable sheath, shall be self-extinguishing, and shall not support combustion. The tape shall not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

3.5 INSTALLATION

- A. Test electrical grounding for compliance with requirements of authorities having jurisdiction.

END OF SECTION 26 05 43

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Conduit color coding.
- E. Voltage markers.
- F. Underground warning tape.
- G. Floor marking tape.
- H. Warning signs and labels.

1.2 RELATED REQUIREMENTS

- A. Division 01 requirements.
- B. Division 26 requirements.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ANSI Z535.4 – American National Standard for Product Safety Signs and Labels.
 - 2. NFPA 70 – National Electrical Code.
 - 3. NFPA 70E – Standard for Electrical Safety in the Workplace.
 - 4. UL 969 – Marking and Labeling Systems.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Division 01.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.7 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 – PRODUCTS**2.1 IDENTIFICATION REQUIREMENTS**

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify main overcurrent protective device.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Motor Control Centers:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify main overcurrent protective device.

- 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
- c. Panelboards:
- 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location.
 - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
 - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
- d. Transformers:
- 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location.
 - 4) Identify load(s) served. Include location.
- e. Enclosed switches, circuit breakers, and motor controllers:
- 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
- f. Time Switches:
- 1) Identify load(s) served and associated circuits controlled. Include location.
- g. Enclosed Contactors:
- 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
 - 4) Identify coil voltage.

- 5) Identify load(s) and associated circuits controlled. Include location.
- h. Transfer Switches:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number for both normal power source and standby power source. Include location.
 - 3) Identify load(s) served. Include location.
 - 4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
- i. Electricity Meters:
 - 1) Identify load(s) metered.
2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
3. Emergency System Equipment:
 - a. Use identification nameplate or identification label to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification label at each piece of service equipment to identify type and location of on-site emergency power sources.
 - c. Use identification label to identify emergency operating instructions for emergency system equipment.
4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
5. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
6. Use identification nameplate or identification label to identify disconnect location for equipment with remote disconnecting means.
7. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.

8. Use identification label on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
9. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
10. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
 - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.
11. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
12. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
13. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
14. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
15. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
16. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple

power sources may be present; Disconnect all electric power including remote disconnects before servicing” or approved equivalent.

C. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes when more than one circuit is present.
 - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
 - d. In cable tray, at maximum intervals of 20 feet.
4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
5. Use underground warning tape to identify direct buried cables.

D. Identification for Raceways:

1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use voltage markers, color-coded bands, or factory-painted conduits to identify specified systems for accessible conduits.
 - a. Maximum Intervals: 20 feet.
 - b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
 - 1) Field-Painting: Comply with Division 09
 - 2) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19.
 - c. Color Code:
 - 1) Emergency Power System:
 - i. Life Safety Branch: Red.
 - ii. Critical Branch: Red.

- 2) Fire Alarm System: Red.
 3. Use identification labels or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
 4. Use identification labels or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
 5. Use underground warning tape to identify underground raceways.
 6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.
- E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
 2. Use color coded boxes to identify specified systems.
 - a. Color-Coded Boxes: Field-painted in accordance with Division 09
 - b. For exposed boxes in public areas, do not color code.
 3. Use identification labels to identify circuits enclosed.
 - a. For exposed boxes in public areas, use only identification labels.
 4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
- F. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
 2. Factory Pre-Marked Wallplates: Comply with Section 26 27 26.
 3. Use identification label to identify fire alarm system devices.
 - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
 4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Construction Management, provide identification on inside surface of wallplate.
 5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

6. Use identification label to identify receptacles protected by upstream GFCI protection, where permitted.
- G. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.
- 2.2 IDENTIFICATION NAMEPLATES AND LABELS
- A. Identification Nameplates:
1. Manufacturers:
 - a. Brimar Industries, Inc
 - b. Kolbi Pipe Marker Co .
 - c. Seton Identification Products
 - d. Substitutions: – See Division 01.
 2. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
 4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
1. Manufacturers:
 - a. Brady Corporation .
 - b. Brother International Corporation
 - c. Panduit Corp
 - d. Substitutions: – See Division 01.
 2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

- a. Use only for indoor locations.
 3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend:
 - a. System designation where applicable:
 - 1) Emergency Power System: Identify with text "EMERGENCY".
 - 2) Fire Alarm System: Identify with text "FIRE ALARM".
 - b. Equipment designation or other approved description.
 - c. Other information as indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. System Designation: 1 inch.
 - b. Equipment Designation: ½ inch.
 - c. Other Information: ¼ inch.
 - d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
 5. Color:
 - a. Normal Power System: White text on black background.
 - b. Emergency Power System: White text on red background.
 - c. Fire Alarm System: White text on red background.
- D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: ¼ inch.
 5. Color: Black text on white background unless otherwise indicated.
 - a. Exceptions:
 - 1) Provide white text on red background for general information or operational instructions for emergency systems.

- 2) Provide white text on red background for general information or operational instructions for fire alarm systems.
- E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: ½ inch.
 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
1. Minimum Size: ¾ inch by 1.5 inches.
 2. Legend: Power source and circuit number or other designation indicated.
 - a. Include voltage and phase for other than 120 V, single phase circuits.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Black text on clear background.
- G. Format for Control Device Identification:
1. Minimum Size: ¾ inch by 1.5 inches.
 2. Legend: Load controlled or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Black text on clear background.
- H. Format for Fire Alarm Device Identification:
1. Minimum Size: ¾ inch by 1.5 inches.
 2. Legend: Designation indicated and device zone or address.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Red text on white background.
- 2.3 WIRE AND CABLE MARKERS
- A. Manufacturers:
1. Brady Corporation
 2. HellermannTyton .

3. Panduit Corp
 4. Substitutions: – See Division 01.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, or plastic sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
1. Do not use handwritten text.
- F. Minimum Text Height: $\frac{1}{8}$ inch.
- G. Color: Black text on white background unless otherwise indicated.
- 2.4 VOLTAGE MARKERS
- A. Manufacturers:
1. Brady Corporation
 2. Brimar Industries
 3. Seton Identification Products
 4. Substitutions: – See Division 01.
- B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- D. Minimum Size:
1. Markers for Equipment: $1 \frac{1}{8}$ by $4 \frac{1}{2}$ inches.
 2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
 3. Markers for Pull Boxes: $1 \frac{1}{8}$ by $4 \frac{1}{2}$ inches.
 4. Markers for Junction Boxes: $\frac{1}{2}$ by $2 \frac{1}{4}$ inches.
- E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
 2. Markers for System Identification:
 - a. Emergency Power System: Text “EMERGENCY”.
 - b. Other Systems: Type of service.

- F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 - 1. Brady Corporation .
 - 2. Brimar Industries, Inc .
 - 3. Seton Identification Products .
 - 4. Substitutions: – See Division 01.
- B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- D. Legend: Type of service, continuously repeated over full length of tape.
- E. Color:
 - 1. Tape for Buried Power Lines: Black text on red background.
 - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 FLOOR MARKING TAPE

- A. Manufacturers:
 - 1. Brady Corporation .
 - 2. Brimar Industries, Inc .
 - 3. Insite Solutions, LLC .
 - 4. Seton Identification Products .
 - 5. Substitutions: – See Division 01.
- B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

- A. Manufacturers:
 - 1. Brimar Industries, Inc .
 - 2. Clarion Safety Systems, LLC .
 - 3. Insite Solutions, LLC .
 - 4. Seton Identification Products .
 - 5. Substitutions: – See Division 01.

- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- C. Warning Signs:
 - 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- D. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - a. Do not use labels designed to be completed using handwritten text.
 - b. Provide polyester overlamine to protect handwritten text.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches unless otherwise indicated.
- E. Floor Signs:
 - 1. Materials: Use factory preprinted, self-adhesive vinyl, polyester, or rubber labels with protective overlamine; removable.
 - 2. Minimum Size: 17-inch diameter unless otherwise indicated.

PART 3 – EXECUTION**3.1 PREPARATION**

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.

4. Elevated Equipment: Legible from the floor or working platform.
 5. Branch Devices: Adjacent to device.
 6. Interior Components: Legible from the point of access.
 7. Conduits: Legible from the floor.
 8. Boxes: Outside face of cover.
 9. Conductors and Cables: Legible from the point of access.
 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- 3.3 FIELD QUALITY CONTROL
- A. See Division 01 specifications
 - B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 05 53

SECTION 26 05 73 – POWER SYSTEM STUDIES**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
 - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 53 – Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
- B. Section 26 24 13 – Switchboards.
- C. Section 26 24 16 – Panelboards.
- D. Section 26 24 19 – Motor-Control Centers.
- E. Section 26 28 13 – Fuses.
- F. Section 26 28 16.16 – Enclosed Switches.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ANSI Z535.4 – American National Standard for Product Safety Signs and Labels.
 - 2. IEEE 141 – IEEE Recommended Practice for Electric Power Distribution for Industrial Plants.
 - 3. IEEE 242 – IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
 - 4. IEEE 399 – IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis.
 - 5. IEEE 551 – IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems.
 - 6. IEEE 1584 – IEEE Guide for Performing Arc-Flash Hazard Calculations.
 - 7. NEMA MG 1 – Motors and Generators.
 - 8. NETA ATS – Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.

9. NFPA 70 – National Electrical Code.
10. NFPA 70E – Standard for Electrical Safety in the Workplace.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
3. Notify Construction Manager of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Submit study reports prior to or concurrent with product submittals.
2. Do not order equipment until matching study reports and product submittals have both been evaluated by the Engineer.
3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

C. Scheduling:

1. Arrange access to existing facility for data collection with Owner.
2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.5 SUBMITTALS

- A. See Division 01 Division 01.
- B. Study preparer's qualifications.
- C. Field testing agency's qualifications.
- D. Study reports, stamped or sealed and signed by study preparer.
- E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
 1. Include characteristic time-current trip curves for protective devices.
 2. Include impedance data for busway.
 3. Include impedance data for engine generators.
 4. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

5. Include documentation of listed series ratings upon request.
6. Identify modifications made in accordance with studies that:
 - a. Can be made at no additional cost to Owner.
 - b. As submitted will involve a change to the contract sum.
- F. Site-specific arc flash hazard warning labels.
- G. Field quality control reports.
- H. Certification that field adjustable protective devices have been set in accordance with requirements of studies.
- I. Project Record Documents: Revise studies as required to reflect as-built conditions.
 1. Include hard copies with operation and maintenance data submittals.
 2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.6 POWER SYSTEM STUDIES

- A. Scope of Studies:
 1. Perform analysis of upgraded electrical distribution system for the admin/lab building as indicated on drawings.
 - a. Include portions of electrical distribution system designated as "future."
 2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
 3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
 - a. Known Operating Modes:
 - 1) Utility as source.
 - 2) Bus tie breaker open/close positions.
 - 3) Maintenance settings.
- B. General Study Requirements:
 1. Comply with NFPA 70.
 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

- C. Data Collection:
1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
 - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
 - 1) Obtain up-to-date information from Owner.
 - b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
 - c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
 - d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, % impedance, and X/R ratio.
 - e. Protective Devices:
 - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
 - 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
 - f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
 - g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
 2. Existing Installations:
 - a. Provide the services of field testing agency or equipment manufacturer's representative to perform field data collection.
 - b. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

- D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
 2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
 - a. Maximum utility fault currents.
 - b. Maximum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
 2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.
- F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
 2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
 - a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
 - b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
 3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
 4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
 - a. Maximum and minimum utility fault currents.

- b. Maximum and minimum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
- G. Study Reports:
- 1. General Requirements:
 - a. Identify date of study and study preparer.
 - b. Identify study methodology and software product(s) used.
 - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
 - d. Identify base used for per unit values.
 - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
 - f. Include conclusions and recommendations.
 - 2. Short-Circuit Study:
 - a. For each scenario, identify at each bus location:
 - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
 - 2) Fault point X/R ratio.
 - 3) Associated equipment short circuit current ratings.
 - b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
 - 3. Protective Device Coordination Study:
 - a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
 - b. For each graph include (where applicable):
 - 1) Partial single-line diagram identifying the portion of the system illustrated.
 - 2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
 - 3) Conductors: Damage curves.
 - 4) Transformers: Inrush points and damage curves.

- 5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
 - 6) Motors: Full load current, starting curves, and damage curves.
 - 7) Capacitors: Full load current and damage curves.
 - c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
 - 1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
 - 2) Include ground fault pickup and delay.
 - 3) Include fuse ratings.
 - 4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
 - d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
- a. For the worst case for each scenario, identify at each bus location:
 - 1) Calculated incident energy and associated working distance.
 - 2) Calculated arc flash boundary.
 - 3) Bolted fault current.
 - 4) Arcing fault current.
 - 5) Clearing time.
 - 6) Arc gap distance.
 - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
 - c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm. OR at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.7 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

1. Study preparer may be OR may not be employed by manufacturer of electrical distribution equipment.
 2. Study preparer may be OR may not be employed by field testing agency.
 - a. Pioneer Power Group.
 3. Study Preparers:
 - a. Substitutions: See Division 01.
- B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.
- C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
1. Products:
 - a. EasyPower LLC
 - b. ETAP/Operation Technology, Inc .
 - c. Power Analytics Corporation .
 - d. SKM Systems Analysis, Inc
 - e. Substitutions: See Division 01.

PART 2 – PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
1. Materials: Comply with Section 26 05 53.
 2. Minimum Size: 4 by 6 inches.
 3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
 - a. Include orange header that reads “WARNING” unless otherwise indicated.
 - b. Include the text “Arc Flash and Shock Hazard; Appropriate PPE Required” or approved equivalent.

- c. Include the following information:
 - 1) Arc flash boundary.
 - 2) Available incident energy and corresponding working distance.
 - 3) Site-specific PPE (personnel protective equipment) requirements.
 - 4) Nominal system voltage.
 - 5) Limited approach boundary.
 - 6) Restricted approach boundary.
 - 7) Equipment identification.
 - 8) Study preparer, report reference, and date calculations were performed.

PART 3 – EXECUTION**3.1 INSTALLATION**

- A. Install arc flash warning labels in accordance with Section 26 05 53.

3.2 FIELD QUALITY CONTROL

- A. See Division 01 requirements
- B. Provide the services of field-testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Adjust equipment and protective devices for compliance with studies and recommended settings.
- E. Notify Construction Manager of any conflicts with or deviations from studies. Obtain direction before proceeding.
- F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.3 CLOSEOUT ACTIVITIES

- A. See Division 01 requirements
- B. Training: Include as part of the base bid OR as an alternate to the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
 - 1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of four hours of training.
 - 3. Instructor: Representative of entity performing study.
 - 4. Location: At project site.

3.4 ATTACHMENTS

- A. Previous studies.
- B. Existing drawings.

END OF SECTION 26 05 73

SECTION 26 08 00 – ELECTRICAL SYSTEMS COMMISSIONING**PART 1 – GENERAL****1.1 COMMISSIONING AGENCY**

- A. The commissioning agency (CA) has been contracted directly with the Owner for this project. The CA has overall responsibility for planning and coordinating the HVAC commissioning process. However, commissioning involves all parties to the design and construction process, including the Electrical (Division 26) Contractor, since many HVAC system components require electrical power and controls to operate as specified.

1.2 CONTRACTOR RESPONSIBILITY

- A. The Electrical (Division 26) Contractor's responsibilities are defined in Section 01 91 13 of the specifications. Each contractor and supplier within Division 26 shall review Section 01 91 13, and their bids shall include provisions for carrying out the work described, as it applies to each Section within the Division 26 specifications, individually and collectively.
- B. The methods and means are the Contractor's responsibility to achieve the intention of phasing the work indicated in 1.03 (A).
- C. The Contractor is responsible for coordinating the power interruption intervals with the owner and all affected parties.
- D. The Contractor is responsible for notifying the owner before any power interruption by at least one week.
- E. The Contractor is responsible to coordinate power interruption with all the affected project trades.

1.3 PHASING OF WORK

- A. The intent of phasing of the work is:
 - 1. One lab shall operational during the construction at any given time.
 - 2. The operatable lab HVAC (Cabinet heater, CU, SS, and AC units) shall remain energized and functional during the operation hours of the lab.
 - 3. The below equipment will be moved during the construction. They shall be powered during the operational hours:
 - a. Autoclave.
 - b. Two ovens.
 - c. Fume hood.
 - 4. The equipment at point (3) shall exist at both labs. Only one set of them shall be used at a time. Simultaneous use is not allowed.
- B. The construction work shall start by changing the main power circuit breakers at both MCC 4901 and MCC 4902 including all the electrical components downstream to PNL 0900 as shown on the one-line diagram.

- C. Power interruption intervals shall be kept to the minimum and during the non-working hours of the admin/lab building.
- D. The electrical work shall accommodate permanent power to the west laboratory during the time of construction at the rest of the building.
- E. Power shall be interrupted at the west lab only after powering the east lab and providing adequate power outlets for the equipment mentioned in 1.03 (A).
- F. Lockout-Tag-Out or equivalent means are required to ensure only one set of the equipment mentioned in 1.03 (A) is operatable at a time.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 26 08 00

SECTION 26 09 23 – LIGHTING CONTROL DEVICES**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Automatic lighting control systems.
- B. Occupancy sensors.
- C. Daylighting controls.
- D. Lighting contactors.
- E. Accessories.

1.2 RELATED REQUIREMENTS

- A. Division 26 specifications

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. 47 CFR 15 – Radio Frequency Devices.
 - 2. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 3. NECA 130 – Standard for Installing and Maintaining Wiring Devices.
 - 4. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 5. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
 - 6. NEMA ICS 2 – Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
 - 7. NEMA ICS 5 – Industrial Control and Systems: Control Circuit and Pilot Devices.
 - 8. NFPA 70 – National Electrical Code.
 - 9. UL 1472 – Solid-State Dimming Controls.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
 - 3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment, or other potential obstructions to motion detection coverage installed under other sections or by others.

4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
 5. Notify Construction Manager of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.
- 1.5 SUBMITTALS
- A. See Division 01 Division 01 requirements.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- C. Shop Drawings:
1. Automatic lighting control systems: provide plans indicating location, model number, and orientation of each lighting control component, including low voltage switches, sensors, power packs, relay panels, networking infrastructure, and all associated system components.
 - a. Include information regarding system network cabling requirements.
 - b. Include all necessary wiring interconnection diagrams.
 2. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
 3. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
- D. Field Quality Control Reports.
- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data: Include detailed information on device programming and setup.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Division 01 for additional provisions.
 2. Extra Locking Receptacle-Mounted Outdoor Photo Controls: 5% of total quantity installed for each type, but not less than two of each type.
 3. Electronic Trip Circuit Breakers: Provide one portable test set.
- H. Project Record Documents: Record actual installed locations and settings for lighting control devices.
- 1.6 QUALITY ASSURANCE
- A. Comply with requirements of NFPA 70.
 - B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
 - C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' documented experience.
 - D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- 1.7 DELIVERY, STORAGE, AND PROTECTION
- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.
- 1.8 FIELD CONDITIONS
- A. Maintain field conditions within manufacturer's required service conditions during and after installation.
- 1.9 WARRANTY
- A. See Division 01.
 - B. Provide five-year manufacturer warranty for all occupancy sensors.
 - C. Provide five-year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.
 - D. Provide two-year manufacturer warranty for all daylighting controls.

PART 2 – PRODUCTS**2.1 LIGHTING CONTROL DEVICES – GENERAL REQUIREMENTS**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
- C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.2 AUTOMATIC LIGHTING CONTROL SYSTEMS

- A. Manufacturers:
 - 1. Acuity Brands Inc.
 - 2. WattStopper.
 - 3. Lutron Electronics Company.
 - 4. Osram Sylvania Inc.
 - 5. Substitutions: See Division 01.
 - 6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. Capacity: system shall be capable of future expansion by at least 25% of installed capacity, including relays, control points, and programmability.
- C. Programming: fully programmable system with serial bus and IP interface for programming and monitoring.
- D. Functionality: system shall be capable of all functions indicated on drawings.
- E. Emergency Egress Lighting: system shall be capable of emergency lighting control in compliance with UL 924, with capability to maintain proper separation from normal lighting in accordance with NFPA 70.

2.3 OCCUPANCY SENSORS

- A. Manufacturers:
 - 1. Hubbell Incorporated.
 - 2. Intermatic, Inc.
 - 3. Lutron Electronics Company, Inc.
 - 4. RAB Lighting, Inc.
 - 5. Sensor Switch Inc.
 - 6. WattStopper.
 - 7. Substitutions: See Division 01.
 - 8. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. All Occupancy Sensors:
 - 1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.

2. Sensor Technology:
 - a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
 - b. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
 3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
 4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
 5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
 6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
 7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
 8. Sensitivity: Field adjustable.
 9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
 10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
 11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
 12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
 13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
- C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 °, integrated manual control capability, and no leakage current to load in off mode.

- b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
 - c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
 - d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - f. Provide selectable audible alert to notify occupant of impending load turn-off.
 - g. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
 - h. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.
2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- a. Products:
 - 1) Lutron Maestro Series.
 - 2) Substitutions: See Division 01.
- D. Wall Dimmer Occupancy Sensors:
- 1. General Requirements:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180°, integrated dimming control capability, and no leakage current to load in OFF mode.
 - b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off). OR Operates only as vacancy sensor (manual-on/automatic-off) in accordance with California Title 24 requirements.
 - c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible

- without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
- e. Provide field adjustable dimming preset for occupied state.
 - f. Provide fade-to-off operation to notify occupant of impending load turn-off.
 - g. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- a. Products:
 - 1) Lutron Maestro C.L Sensor Dimmer Series .
 - 2) Lutron Maestro Occupancy Sensor Dimmer Series .
 - 3) Lutron Maestro 0-10V Dimmer Sensor Series .
 - 4) Substitutions: See Division 01.
- E. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
- a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
 - c. Provide field selectable setting for disabling LED motion detector visual indicator.
 - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
 - e. Finish: White unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
- a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360°.
 - 1) Products:
 - i. Lutron LOS-CDT Series.
 - ii. Substitutions: See Division 01.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360°.

- 1) Products:
 - i. Lutron LOS-CDT Series.
 - ii. Substitutions: See Division 01.
- 3. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360°.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.
- F. Accessories:
 - 1. Provide heavy-duty coated steel wire protective guards compatible with specified occupancy sensors where indicated.

2.4 DAYLIGHTING CONTROLS

- A. Manufacturers:
 - 1. Hubbell Control Solutions.
 - 2. Lutron Electronics Company, Inc.
 - 3. Sensor Switch Inc.
 - 4. WattStopper.
 - 5. Substitutions: See Division 01.
 - 6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.
- C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
 - 1. Sensor Type: Filtered silicon photo diode.
 - 2. Sensor Range:
 - a. Indoor Photo Sensors: 5 to 100 footcandles.
 - 3. Finish: White unless otherwise indicated.
 - 4. Where wired sensors are indicated, wireless sensors are not acceptable without prior approval of Construction Manager.

- D. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.
- E. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
 2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
 3. Control Capability:
 - a. Single Zone Switching Modules: Capable of controlling one programmable channel.
 - b. Multi-Zone Switching Modules: Capable of controlling up to three separately programmable channels.
- F. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
 2. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
 3. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
 4. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
 5. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.
 6. Output Voltage: Compatible with specified dimming ballasts.
- G. Power Packs for Low Voltage Daylighting Control Modules:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.

2. Input Supply Voltage: Dual rated for 120/277 VAC.
 3. Load Ratings: As required to control the load indicated on drawings.
- H. Accessories:
1. Where indicated, provide compatible accessory wall switches for manual override control.
 2. Where indicated, provide compatible accessory wireless controls for manual override control.
 - a. Products:
 - 1) Lutron Pico Wireless Controls .
 - 2) Substitutions: See Division 01.

2.5 LIGHTING CONTACTORS

- A. Manufacturers:
1. ABB/GE.
 2. Eaton Corporation.
 3. Rockwell Automation Inc; Allen-Bradley Products.
 4. Schneider Electric; Square D Products.
 5. Siemens Industry, Inc.
 6. Substitutions: See Division 01.
- B. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.
- C. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect.
1. Disconnects:
 - a. Disconnect Switches: Fusible or nonfusible type as indicated. or fusible type unless otherwise indicated.
 - b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
 - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.

- D. Short Circuit Current Rating:
 - 1. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
- E. Enclosures:
 - 1. Comply with NEMA ICS 6.
 - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
 - b. Outdoor Locations: Type 3R or Type 4.
 - 3. Finish: Manufacturer's standard unless otherwise indicated.

2.6 ACCESSORIES

- A. Auxiliary Contacts: Circuit breaker type, disconnect switch type, or circuit breaker or disconnect switch type as indicated.
 - 1. Comply with NEMA ICS 5.
 - 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.
- B. Pilot Devices:
 - 1. Comply with NEMA ICS 5; heavy-duty type.
 - 2. Nominal Size: 30 mm.
 - 3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
 - 4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
 - 5. Indicating Lights: Push-to-test type unless otherwise indicated.
 - 6. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
 - 1. Comply with NEMA ICS 5.
 - 2. Provide number and type of relays indicated or required to perform necessary functions.
 - 3. Timing Relays: Electronic or pneumatic as indicated.

- a. Adjustable Timing Range: As indicated on drawings.
- D. Fire-Rated Device Enclosures:
 - 1. Manufacturers:
 - a. Fire-Rated Product Specialties Corp .
 - b. Substitutions: See Division 01.
 - 2. Provide as required to preserve fire resistance rating of building elements.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of lighting control devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
 - b. In-Wall Time Switches: 48 inches above finished floor.
 - c. In-Wall Interval Timers: 48 inches above finished floor.

2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
 3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Construction Manager to obtain direction prior to proceeding with work.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.
- G. Provide required supports in accordance with Section 26 05 29.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Identify lighting control devices in accordance with Section 26 05 53.
- J. Occupancy Sensor Locations:
1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Construction Manager.
 2. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
 3. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
 4. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- K. Daylighting Control Photo Sensor Locations:
1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Construction Manager.

2. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize control and avoid conflicts or problems affecting proper detection of light levels.
 3. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
 4. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
 5. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
- L. Combination Enclosed Lighting Contactors:
1. Except where indicated to be mounted adjacent to the equipment they supply, mount lighting contactors such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
 2. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.
- M. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- N. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
- O. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
- P. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off the power pack.
- Q. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 05 33.16 for mounting of lighting control device system components.
- 3.4 FIELD QUALITY CONTROL
- A. See Division 01 requirements .
 - B. Inspect each lighting control device for damage and defects.

- C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- D. Test time switches to verify proper operation.
- E. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Construction Manager.
- C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
- D. Where indicated or as directed by Construction Manager, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Construction Manager. Record settings in written report to be included with submittals.
- F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Construction Manager.
- G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Construction Manager. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Construction Manager.

3.6 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

- A. See Division 01 specifications
- B. Demonstration: Demonstrate proper operation of lighting control devices to Construction Manager, and correct deficiencies or make adjustments as directed.

- C. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Instructor: Manufacturer's authorized service representative or Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
 - 3. Location: At project site.

END OF SECTION 26 09 23

SECTION 26 22 00 – LOW-VOLTAGE TRANSFORMERS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. General purpose transformers.
- B. Shielded transformers.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 – Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.13 – Conduit for Electrical Systems: Flexible conduit connections.
- E. Section 26 05 53 – Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. 10 CFR 431, Subpart K – Energy Efficiency Program for Certain Commercial and Industrial Equipment – Distribution Transformers.
 - 2. IEEE C57.94 – IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers.
 - 3. IEEE C57.96 – IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers.
 - 4. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 5. NECA 409 – Standard for Installing and Maintaining Dry-Type Transformers.
 - 6. NEMA ST 20 – Dry Type Transformers for General Applications.
 - 7. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 8. NETA ATS – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
 - 9. NFPA 70 – National Electrical Code.
 - 10. UL 506 – Standard for Specialty Transformers.
 - 11. UL 1561 – Standard for Dry-Type General Purpose and Power Transformers.

1.4 ADMINISTRATIVE REQUIREMENTS**A. Coordination:**

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Construction Manager of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section Division 0126 05 00 – Common Work Results for Electrical for submittal procedures.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
 1. Vibration Isolators: Include attachment method and rated load and deflection.
 2. Shielded Transformers: Include shielding method and noise attenuation performance.
- C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
- D. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Maintenance Data: Include recommended maintenance procedures and intervals.
- H. Project Record Documents: Record actual locations of transformers.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

- A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
 - 1. Greater than 10 kVA: 104°F maximum.
 - 2. Less than 10 kVA: 77°F maximum.

1.9 WARRANTY

- A. See Division 01 requirements.

PART 2 – PRODUCTS**2.1 MANUFACTURERS**

- A. ABB/GE.
- B. Eaton Corporation.
- C. Schneider Electric; Square D Products .
- D. Siemens Industry, Inc .
- E. Substitutions: See Division 01.

2.2 TRANSFORMERS – GENERAL REQUIREMENTS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:

1. Altitude: Less than 3,300 feet.
2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104°F.
 - b. Less than 10 kVA: Not exceeding 77°F.
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 % primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.
- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.3 GENERAL PURPOSE TRANSFORMERS

- A. The basis of design is one of the following:
 1. Sentinel General Purpose SG3L0250KE single phase 250kva 480v-120/240V 60HZ AL.
 2. Distribution Transformer MF250KEAH7 single phase 250kva 480v-120/240V 60HZ AL.
- B. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- C. Primary Voltage: 480 volts delta, 3-phase.
- D. Secondary Voltage: 120/240 volts, 1 phase.
- E. Insulation System and Allowable Average Winding Temperature Rise:
 1. Less than 15 kVA: Class 180°C insulation system with 115°C average winding temperature rise.
 2. 15 kVA and Larger: Class 220°C insulation system with 150°C average winding temperature rise.
- F. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
- G. Winding Taps:
 1. Less than 3 kVA: None.

2. 3 kVA through 15 kVA: Two 5% full capacity primary taps below rated voltage.
 3. 15 kVA through 300 kVA: Two 2.5% full capacity primary taps above and four 2.5 % full capacity primary taps below rated voltage.
 4. 500 kVA and Larger: Two 2.5% full capacity primary taps above and two 2.5 % full capacity primary taps below rated voltage.
- H. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
- I. Sound Levels: Standard sound levels complying with NEMA ST 20
- J. Mounting Provisions:
1. Less than 15 kVA: Suitable for wall mounting.
 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
 3. Larger than 75 kVA: Suitable for floor mounting.
- K. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Outdoor locations: Type 3R.
 2. Construction: Steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 4. Provide lifting eyes or brackets.
- L. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
 2. Weathershield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA 250, type 3R assembly.
 3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.
- 2.4 SHIELDED TRANSFORMERS
- A. Description: Self-cooled, two winding, shielded isolation transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
 - B. Primary Voltage: 480 volts delta, 3-phase.
 - C. Secondary Voltage: 120/240 volts, 1 phase.
 - D. Insulation System and Allowable Average Winding Temperature Rise:

1. Less than 15 kVA: Class 180°C insulation system with 115°C average winding temperature rise.
 2. 15 kVA and Larger: Class 220°C insulation system with 150°C average winding temperature rise.
- E. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
- F. Winding Taps:
1. Less than 3 kVA: None.
 2. 3 kVA through 15 kVA: Two 5% full capacity primary taps below rated voltage.
 3. 15 kVA through 300 kVA: Two 2.5% full capacity primary taps above and four 2.5 % full capacity primary taps below rated voltage.
 4. 500 kVA and Larger: Two 2.5% full capacity primary taps above and two 2.5% full capacity primary taps below rated voltage.
- G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
- H. Sound Levels: Standard sound levels complying with NEMA ST 20.
- I. Winding Shield: Electrostatic, with separate insulated grounding connection.
- J. Mounting Provisions:
1. Less than 15 kVA: Suitable for wall mounting.
 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
 3. Larger than 75 kVA: Suitable for floor mounting.
- K. Transformer Enclosure : Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Outdoor locations Type 3R.
 2. Construction: Steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 4. Provide lifting eyes or brackets.
- L. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
 2. Weather Shield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA 250, type 3R assembly.

3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.5 SOURCE QUALITY CONTROL

- A. Factory test transformers according to NEMA ST 20.
- B. Sound Level Tests: Perform factory test designated in NEMA ST 20 as “design” test on each production unit.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer’s instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer’s instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 26 05 33.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer’s instructions and NFPA 70.
- F. Install transformers plumb and level.
- G. Transformer Support:
 1. Provide required support and attachment in accordance with Section 26 05 29, where not furnished by transformer manufacturer.
 2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
 3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Division 03.
 4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support

from building structure. Do not provide support from piping, ductwork, or other systems.

- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.
- K. Where furnished as a separate accessory, install transformer weather shield per manufacturer's instructions.
- L. Identify transformers in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 40 00 – Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.
 - 1. 167 kVA single phase, 500 kVA three phase and smaller:
 - a. Perform turns ratio tests at all tap positions.

3.4 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 22 00

SECTION 26 24 13 – SWITCHBOARDS**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

1.2 RELATED REQUIREMENTS

- A. Division 03
- B. Division 26

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. FS W-C-375 – Circuit Breakers, Molded Case; Branch Circuit and Service.
 - 2. IEEE C57.13 – IEEE Standard Requirements for Instrument Transformers.
 - 3. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 4. NECA 400 – Standard for Installing and Maintaining Switchboards.
 - 5. NEMA 250 – Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - 6. NEMA PB 2 – Deadfront Distribution Switchboards.
 - 7. NEMA PB 2.1 – General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 1000 Volts or Less.
 - 8. NETA ATS – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
 - 9. NFPA 70 – National Electrical Code.
 - 10. UL 98 – Enclosed and Dead-Front Switches.
 - 11. UL 489 – Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
 - 12. UL 869A – Reference Standard for Service Equipment.
 - 13. UL 891 – Switchboards.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
 5. Notify Construction Management of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:
1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
 2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
 3. See Section 26 21 00 for Utility Company contact information and additional requirements.
 4. Obtain Utility Company approval of switchboard prior to fabrication.
 5. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
 6. Arrange for inspections necessary to obtain Utility Company approval of installation.
- 1.5 SUBMITTALS
- A. See Division 01 Division 01 requirements.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
1. Include characteristic trip curves for each type and rating of overcurrent protective device
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 4. Include documentation of listed series ratings upon request. .

5. Include documentation demonstrating total selective coordination.
6. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Field Quality Control Test Reports.
- H. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.
- I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Division 01 requirements.
 2. Enclosure Keys: Two of each different key.
 3. Electronic Trip Circuit Breakers: Provide one portable test set.
 4. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Switchboards:
 - 1. ABB/GE.
 - 2. Eaton Corporation.
 - 3. Schneider Electric; Square D Products.
 - 4. Siemens Industry, Inc.
- B. Substitutions: See Division 01 requirements.
- C. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Front-Connected Switchboards:
 - 1. Main Device(s): Individually-mounted.
 - 2. Feeder Devices: Panel/group-mounted or individually mounted.
 - 3. Arrangement: Front accessible only (not rear accessible), rear aligned.
 - 4. Gutter Access: Bolted covers.
- E. Service Entrance Switchboards:
 - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.

2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
 3. Comply with Utility Company requirements for electrical service.
 4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
- F. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude: Less than 6,600 feet.
 - b. Ambient Temperature:
 - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23°F and 104°F.
 - 2) Switchboards Containing Fusible Switches: Between -22°F and 104°F.
 2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- G. Short Circuit Current Rating:
1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
 2. Minimum Rating: 65,000 rms symmetrical amperes.
 3. Listed series ratings are not acceptable.
 4. Label equipment utilizing series ratings as required by NFPA 70.
- H. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve total selective coordination.
- I. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- J. Bussing: Sized in accordance with UL 891 temperature rise requirements.
1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 4. Phase and Neutral Bus Material: Aluminum or copper.
 5. Ground Bus Material: Aluminum or copper.
- K. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
 - b. Main and Neutral Lug Type: Compression.
 2. Load Conductor Terminations:
 - a. Lug Material: Copper, suitable for terminating copper conductors only.
 - b. Lug Type: _____
- L. Enclosures:
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations: or As indicated on the drawings.
 - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
 - b. Outdoor Locations: Type 3R.
 2. Finish: Manufacturer's standard unless otherwise indicated.
 3. Enclosure Space Heaters:
 - a. Provide in each switchboard section installed outdoors and in unconditioned indoor spaces.
 - b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
 - c. Heater Control: Thermostat.
 - d. Heater Power Source: Provide connection to transformer factory-installed in switchboard or suitable external branch circuit as indicated or as required.
 4. Outdoor Enclosures:
 - a. Enclosure Type: Non-walk-in type unless otherwise indicated. or walk-in type.
 - b. Color: _____. or Custom color to be selected by Construction Management / Architect . or Manufacturer's standard
 - c. Access Doors: Lockable, with all locks keyed alike.

- d. Walk-in Enclosure Features:
 - 1) Personnel Doors: Open to exterior; equipped with panic hardware.
 - 2) Aisle lighting, with switch at each access door.
 - 3) GFCI duplex convenience receptacle.
- M. Future Provisions:
 - 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
 - 2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
 - 3. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.
- N. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list switchboards as a complete assembly including surge protective device.
- O. Owner Metering:
 - 1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
 - 2. Measured Parameters:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase[and neutral.]
 - c. Frequency (Hz).
 - d. Real power (kW): For each phase, 3-phase total.
 - e. Reactive power (kVAR): For each phase, 3-phase total.
 - f. Apparent power (kVA): For each phase, 3-phase total.
 - g. Power factor.
 - h. Real energy (kWh).
 - i. Current demand.
 - j. Power demand: Real, reactive, and apparent.
 - 3. Meter Accuracy: Plus/minus 1.0 percent. or 0.5% or 0.2%
 - 4. Features:
 - a. Communications Capability: _____. or Utilize Modbus communications protocol Provide all accessories necessary for proper interface.

- b. KYZ pulse output.
 - c. Adjustable demand interval.
 - d. Remote monitoring capability[via PC.]
- P. Instrument Transformers:
- 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.3 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
- 1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 200 amperes.
 - 2) Provide electronic trip circuit breakers for circuit breaker frame sizes 200 amperes and above.
 - b. Minimum Interrupting Capacity:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2) 14,000 rms symmetrical amperes at 480 VAC.
 - c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 200 amperes and larger.
 - 2) Provide interchangeable trip units where indicated.

- d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1) Provide the following field-adjustable trip response settings:
 - i. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - ii. Long time delay.
 - iii. Short time pickup and delay.
 - iv. Instantaneous pickup.
 - e. Provide the following circuit breaker types where indicated:
 - 1) 100% Rated Circuit Breakers: Listed for application within the switchboard where installed at 100% of the continuous current rating.
 - 2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
 - f. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
 - 2) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage [with field-adjustable time delay to prevent nuisance tripping.]
3. Insulated Case Circuit Breakers:
- a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; 100 % rated or _____ ; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated [on the drawings.]
 - b. Operation:
 - 1) Provide manually operated circuit breakers[unless otherwise indicated.]
 - 2) Pad-Lock Provision: For preventing circuit breaker closing operation.
 - c. Construction:
 - 1) Provide fixed-mount circuit breakers[unless otherwise indicated.] or [] or [this sentence ends at breakers]

- d. Minimum Interrupting Capacity:
 - 1) 42,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2) 65,000 rms symmetrical amperes at 480 VAC.
- e. Trip Units: Solid state, microprocessor-based, true rms sensing.
 - 1) Provide the following field-adjustable trip response settings:
 - i. Long time pickup, adjustable by setting dial.
 - ii. Long time delay.
 - iii. Short time pickup and delay.
 - iv. Instantaneous pickup.
- f. Provide the following circuit breaker types where indicated:
 - 1) 100% Rated Circuit Breakers: Listed for application within the switchboard where installed at 100% of the continuous current rating.
 - 2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
- g. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage [with field-adjustable time delay to prevent nuisance tripping.]

2.4 SOURCE QUALITY CONTROL

- A. See Division 01 requirements.
- B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
 - 1. Dielectric tests.
 - 2. Mechanical operation tests.
 - 3. Grounding of instrument transformer cases test.
 - 4. Electrical operation and control wiring tests, including polarity and sequence tests.
 - 5. Ground-fault sensing equipment test.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of ½ inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Install switchboards plumb and level.
- H. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad .
- I. Provide grounding and bonding in accordance with Section 26 05 26.
- J. Install all field-installed devices, components, and accessories.
- K. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.
- M. Provide filler plates to cover unused spaces in switchboards.
- N. Identify switchboards in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

- A. See Division 01 requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

- C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
 - D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
 - E. Inspect and test in accordance with NETA ATS, except Section 4.
 - F. Perform inspections and tests listed in NETA ATS, Section 7.1.
 - G. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
 - H. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.
 - 1. Perform insulation-resistance tests on all control wiring with respect to ground.
 - 2. Test functions of the trip unit by means of secondary injection.
 - I. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
 - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
 - J. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
 - K. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
 - L. Test shunt trips to verify proper operation.
 - M. Correct deficiencies and replace damaged or defective switchboards or associated components.
 - N. Submit detailed reports indicating inspection and testing results and corrective actions taken.
- 3.4 ADJUSTING
- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
 - B. Adjust alignment of switchboard covers and doors.
- 3.5 CLEANING
- A. See Division 01 requirements.
 - B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

- C. Repair scratched or marred surfaces to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 – Closeout Submittals, for closeout submittals.

3.7 PROTECTION

- A. Protect installed switchboards from subsequent construction operations.

END OF SECTION 26 24 13

SECTION 26 24 16 – PANELBOARDS**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- C. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.
 - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- D. Section 26 05 53 – Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 05 73 – Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- F. Section 26 28 13 – Fuses: Fuses for fusible switches and spare fuse cabinets.
- G. Section 26 43 00 – Surge Protective Devices.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. FS W-C-375 – Circuit Breakers, Molded Case; Branch Circuit and Service.
 - 2. FS W-P-115 – Federal Specification, Panel, Power Distribution.
 - 3. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 4. NECA 407 – Standard for Installing and Maintaining Panelboards.
 - 5. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 6. NEMA KS 1 – Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
 - 7. NEMA PB 1 – Panelboards.
 - 8. NEMA PB 1.1 – General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less.
 - 9. NETA ATS – Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems.

10. NFPA 70 – National Electrical Code.
11. UL 50 – Enclosures for Electrical Equipment, Non-Environmental Considerations.
12. UL 50E – Enclosures for Electrical Equipment, Environmental Considerations.
13. UL 67 – Panelboards.
14. UL 98 – Enclosed and Dead-Front Switches.
15. UL 489 – Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
16. UL 869A – Reference Standard for Service Equipment.
17. UL 943 – Ground-Fault Circuit-Interrupters.
18. UL 1699 – Arc-Fault Circuit-Interrupters.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Construction Management of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section Division 01 – Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 1. Include the following information:
 - a. Panelboard type.
 - b. Main bus and terminal connection sizes
 - c. Location of line connections.

- d. Cabinet dimensions.
 - e. Gutter space.
 - f. Gauge of boxes and fronts.
 - g. Finish data.
 - h. Voltage and amp ratings.
 - i. Panel schedule, including breaker or fuse types, trip ratings, and interrupting ratings.
2. Include characteristic trip curves for each type and rating of overcurrent protective device.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 4. Include documentation of listed series ratings.
 5. Identify mounting conditions required for equipment seismic qualification.
 6. For each panelboard, submit manufacturer's name and data as required:
 - a. Breaker types, trip ratings, and interrupting ratings.
 - b. Cabinet dimensions with conduit entrance and exit locations.
 - c. Finish data.
 - d. Gauge of boxes and fronts.
 - e. Gutter space.
 - f. Location of line connections.
 - g. Main bus and terminal connection sizes.
 - h. Panelboard type.
 - i. Voltage rating.
- D. Manufacturer's equipment seismic qualification certification.
- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.
- F. Field Quality Control Test Reports.

- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
 - H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
 - I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
 - J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 – Product Requirements, for additional provisions.
 - 2. Panelboard Keys: Two of each different key.
 - 3. Spare Fuses: Provide spare fuses for each fusible panelboard consisting of three fuses of each size installed in the panelboard.
 - 4. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.
- 1.6 QUALITY ASSURANCE
- A. Comply with requirements of NFPA 70.
 - B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
 - C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.
 - D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
 - B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
 - C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.
- 1.8 FIELD CONDITIONS
- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
 - 1. Panelboards Containing Circuit Breakers: Between 23°F and 104°F .

2. Panelboards Containing Fusible Switches: Between -22°F and 104°F.

PART 2 – PRODUCTS**2.1 MANUFACTURERS**

- A. ABB
- B. Eaton Corporation
- C. Schneider Electric
- D. Siemens Industry
- E. Substitutions: See Division 01 –
- F. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

2.2 PANELBOARDS – GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. General: All panelboards shall be the automatic circuit breaker type. The number and arrangement of circuits, trip ratings, spares and blank spaces for future circuit breakers shall be as shown on the Drawings. All circuit breakers shall be quick-break bolt-on type, and one-, two-, or three-pole as shown on the Drawings, each with a single operating handle.
 1. Each panelboard shall have a field-mounted identifying plastic nameplate giving the panel identification as shown on the Drawings. In addition, each panelboard shall have a manufacturer's nameplate showing the voltage, bus rating, phase, frequency and number of wires.
 2. For panelboards used in dry locations, finish of doors and trim shall be ANSI 61 or 49. Boxes of all such panelboards shall be galvanized, field finished to match the fronts.
 3. Provide NEMA panelboard as required by classification and as shown on the Drawing.
 4. Panelboards and enclosures shall conform to NEMA PB 1 and NEMA 250, UL 50, and requirements of all relevant codes. Panelboards used as service equipment shall conform to UL 869A.
- C. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 1. Altitude: Less than 6,600 feet.

2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23°F and 104°F
 - b. Panelboards Containing Fusible Switches: Between -22°F and 104°F.
- E. Short Circuit Current Rating:
 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
 2. Listed series ratings are not acceptable.
 3. Label equipment utilizing series ratings as required by NFPA 70.
- F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- H. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 3. Provide separate isolated/insulated ground bus _____.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
 - c. Provide painted steel boxes for surface-mounted panelboards, finish to match fronts.

3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.
- M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve total selective coordination.

2.3 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker or fusible switch type as indicated, and listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.
- B. Distribution panelboards shall be rated 480Y/277 volts, 4-wire, with bus ratings as shown on the Drawings. They shall meet the requirements of FS W-P-115 for Type I, Class 1 panelboards with circuit breakers meeting FS W-C-375 or Class 2d and 3a circuit breakers. Distribution panelboards shall be large enough for double branch mounting of branch circuit breakers up to 600 amp and shall be surface mounted. Circuit breakers shall have minimum interrupting ratings of 14,000 RMS symmetrical amperes at 480 volts.
 1. Each branch circuit shall be identified by an engraved plastic nameplate as shown on the Drawings.
 2. Distribution panelboards shall be Square D I-Line with Type FA or larger breakers; Eaton Cutler Hammer Pow-R-Line 3 with Series C Type FDB or larger breakers; or approved equal.
- C. Products:
 1. Eaton Corporation.
 2. Schneider Electric; Square D Products.
 3. Siemens Industry, Inc.
 4. Substitutions: See Section 01 60 00 – Product Requirements.

- D. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
 - 2. Main and Neutral Lug Type: Mechanical.
 - E. Bussing:
 - 1. Phase and Neutral Bus Material: Copper.
 - 2. Ground Bus Material: Copper.
 - F. Circuit Breakers:
 - 1. Provide bolt-on type as indicated on the drawings..
 - 2. Provide thermal magnetic circuit breakers.
 - 3. Provide electronic trip circuit breakers for circuit breaker frame sizes 200 amperes and above.
 - G. Enclosures:
 - 1. Provide surface-mounted enclosures as indicated.
 - 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.
- 2.4 LIGHTING AND APPLIANCE PANELBOARDS
- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.
 - B. General: Lighting panelboards shall be rated as shown on the Drawings. Panelboards shall meet the requirements of FS W-P-115 for Type I, Class 1 panelboards with circuit breakers.
 - C. Lighting panelboards shall have front doors with key latch, common keying and a typed directory card and holder. Panelboard circuits shall be arranged with odd numbers on the left and even numbers on the right.
 - D. Circuit Breakers: Circuit breakers shall be the molded case type with ratings as shown on the Drawings. Circuit breakers shall have interrupting ratings of 10,000 RMS symmetrical amperes at 120/240 volts.
 - E. Products:
 - 1. Eaton Corporation.
 - 2. Schneider Electric, Square D Products.
 - 3. Siemens Industry, Inc.
 - 4. Substitutions: See Section 01 60 00 – Product Requirements.

- F. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
 - 2. Main and Neutral Lug Type: Mechanical.
- G. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Copper.
 - 3. Ground Bus Material: Copper.
- H. Circuit Breakers: Thermal magnetic bolt-on or plug-in type.
- I. Enclosures:
 - 1. Provide flush-mounted enclosures as indicated.
 - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic or metal circuit directory holder mounted on inside of door.

2.5 OVERCURRENT PROTECTIVE DEVICES

- A. Fusible Switches:
 - 1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 - 2. Fuse Clips: As required to accept indicated fuses.
 - 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- B. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489 and complying with FS W-C-375.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.

- 2) 14,000 rms symmetrical amperes at 480 VAC.
- b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Provide compression lugs where indicated.
 - c. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 200 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - a. Provide the following field-adjustable trip response settings:
 - 1) Long time pickup, adjustable by setting dial.
 - 2) Long time delay.
 - 3) Short time pickup and delay.
 - 4) Instantaneous pickup.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
 - d. 100% Rated Circuit Breakers: Listed for application within the panelboard where installed at 100% of the continuous current rating.
 - e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
8. Do not use handle ties in lieu of multi-pole circuit breakers.

9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
10. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Handle Padlock Provision: For locking circuit breaker handle in OFF position.
 - b. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

2.6 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 – Quality Requirements, for additional requirements.
- B. Factory test panelboards according to NEMA PB 1.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling, or below floor.
- J. Provide grounding and bonding in accordance with Section 26 05 26.

1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.
- M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- N. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- O. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.
- P. Provide filler plates to cover unused spaces in panelboards.
- Q. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads. Also provide for the following:
1. Emergency and night lighting circuits.
 2. Fire detection and alarm circuits.
 3. Communications equipment circuits.
- R. Identify panelboards in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 40 00 – Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required, except for the following:
1. Perform insulation-resistance tests on all control wiring with respect to ground.
 2. Test functions of the trip unit by means of secondary injection.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Test AFCI circuit breakers to verify proper operation.

- G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20% and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates and covers.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- C. Section 26 05 33.16 – Boxes for Electrical Systems.
- D. Section 26 05 53 – Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 09 23 – Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. FS W-C-596 – Connector, Electrical, Power, General Specification for.
 - 2. FS W-S-896 – Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).
 - 3. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 4. NECA 130 – Standard for Installing and Maintaining Wiring Devices.
 - 5. NEMA WD 1 – General Color Requirements for Wiring Devices.
 - 6. NEMA WD 6 – Wiring Devices – Dimensional Specifications.
 - 7. NFPA 70 – National Electrical Code.
 - 8. UL 20 – General-Use Snap Switches.
 - 9. UL 498 – Attachment Plugs and Receptacles.
 - 10. UL 514D – Cover Plates for Flush-Mounted Wiring Devices.
 - 11. UL 943 – Ground-Fault Circuit-Interruptioners.
 - 12. UL 1472 – Solid-State Dimming Controls.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
 - 6. Notify Construction Management of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section Division 01 – Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer’s catalog information showing dimensions, colors, and configurations.
 - 1. Wall Dimmers: Include derating information for ganged multiple devices.
- C. Samples: One for each type and color of device and wall plate specified.
- D. Field Quality Control Test Reports.
- E. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data:
 - 1. Wall Dimmers: Include information on operation and setting of presets.
 - 2. GFCI Receptacles: Include information on status indicators.
- G. Project Record Documents: Record actual installed locations of wiring devices.
- H. Maintenance Materials: Furnish the following for Owner’s use in maintenance of project.
 - 1. See Division 01, for additional provisions.

2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
3. Extra Keys for Locking Switches: Two of each type.
4. Extra Wall Plates: One of each style, size, and finish.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 – PRODUCTS

2.1 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.2 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: Ivory with or Ivory wall plate.
- C. Wiring Devices Installed in Finished Spaces: Ivory with Ivory wall plate.
- D. Wiring Devices Installed in Unfinished Spaces: Gray wall plate.

- E. Wiring Devices Installed in Wet or Damp Locations: Ivory with specified weatherproof cover.

2.3 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated .
 - 2. Leviton Manufacturing Company, Inc .
 - 3. Pass & Seymour, a brand of Legrand North America, Inc;
 - 4. Substitutions: See Division 01.
- B. Wall Switches – General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.4 WALL DIMMERS

- A. Manufacturers:
 - 1. Leviton Manufacturing Company, Inc .
 - 2. Lutron Electronics Company, Inc; Maestro Series .
 - 3. Substitutions: See Division 01.
- B. Wall Dimmers – General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- C. Control: Slide control type with separate on/off switch.
- D. Provide locator light, illuminated with load off.
- E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.5 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Incorporated .

2. Leviton Manufacturing Company, Inc .
 3. Lutron Electronics Company, Inc; Designer Style .
 4. Pass & Seymour, a brand of Legrand North America, Inc .
 5. Substitutions: See Division 01.
 6. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Receptacles – General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 2. NEMA configurations specified are according to NEMA WD 6.
 3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
- C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
 3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:
1. GFCI Receptacles – General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

2.6 WALL PLATES AND COVERS

- A. Manufacturers:
1. Hubbell Incorporated .
 2. Intermatic, Inc .
 3. Leviton Manufacturing Company, Inc .
 4. Lutron Electronics Company, Inc
 5. Pass & Seymour, a brand of Legrand North America, Inc .
 6. Substitutions: See Division 01.
 7. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard; _____.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
 4. Provide screwless wallplates with concealed mounting hardware where indicated.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- E. Brass Wall Plates: Brushed satin finish, factory-coated to inhibit oxidation.
- F. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.
- G. Chrome Wall Plates: Smooth finish, chrome plated steel.
- H. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- I. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.
- J. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- K. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that core drilled holes for poke-through assemblies are in proper locations.
- H. Verify that openings in access floor are in proper locations.
- I. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches above finished floor.
 - b. Wall Dimmers: 48 inches above finished floor.
 - c. Fan Speed Controllers: 48 inches above finished floor.
 - d. Receptacles: 18 inches above finished floor or 6 inches above counter.
 - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Construction Management to obtain direction prior to proceeding with work.
 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
 6. Install wiring devices in accordance with manufacturer's instructions.
- C. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
 - D. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
 - E. Connect wiring devices by wrapping conductor clockwise $\frac{3}{4}$ turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
 - F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - G. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.
 - H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
 - I. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.
 - J. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
 - K. Install wiring devices plumb and level with mounting yoke held rigidly in place.
 - L. Install wall switches with OFF position down.
 - M. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
 - N. Do not share neutral conductor on branch circuits utilizing wall dimmers.
 - O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
 - P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

- Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- R. Identify wiring devices in accordance with Section 26 05 53.
- S. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 – Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Construction Management.

3.6 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

SECTION 26 28 16.16 – ENCLOSED SWITCHES**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

- A. Division 26 Specifications.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.

1. NECA 1 – Standard for Good Workmanship in Electrical Construction.
2. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
3. NEMA KS 1 – Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
4. NFPA 70 – National Electrical Code.
5. UL 50 – Enclosures for Electrical Equipment, Non-Environmental Considerations.
6. UL 50E – Enclosures for Electrical Equipment, Environmental Considerations.
7. UL 98 – Enclosed and Dead-Front Switches.
8. UL 248-1 – Low-Voltage Fuses – Part 1: General Requirements.
9. UL 869A – Reference Standard for Service Equipment.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Construction Management of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Division 01 Division 01 for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
 - 2. Include wiring diagrams showing all factory and field connections.
 - 3. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Project Record Documents: Record actual locations of enclosed switches.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Division 01 for additional provisions.
 - 2. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperature between -22°F and 104°F during and after installation of enclosed switches.

PART 2 – PRODUCTS**2.1 MANUFACTURERS**

- A. ABB/GE.
- B. Eaton Corporation.
- C. Schneider Electric; Square D Products.
- D. Siemens Industry, Inc.
- E. Substitutions: See Division 01.
- F. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project [OR by a single manufacturer] and obtained from a single supplier.

2.2 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy or general duty as indicated; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22°F and 104°F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed

- location as determined by short circuit study performed in accordance with Section 26 05 73.
2. Minimum Ratings:
 - a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
 - b. General Duty Single Throw Switches Protected by Class R Fuses: 100,000 rms symmetrical amperes.
 - c. Heavy-Duty Single Throw Switches Protected by Class R Fuses: 200,000 rms symmetrical amperes.
 - d. Double Throw Switches Protected by Class R Fuses: 100,000 rms symmetrical amperes.
 - G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
 - H. Provide with switch blade contact position that is visible when the cover is open.
 - I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
 - J. Conductor Terminations: Suitable for use with the conductors to be installed.
 - K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
 - L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
 - M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations: or [as indicated on the drawings]
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R. or Type 4X, stainless steel.
 - c. Corrosive Locations: Type 4X.
 - d. Wet Locations: Type 4.
 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
 - N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
 - O. Heavy-Duty Switches:
 1. Comply with NEMA KS 1.

2. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Provide compression lugs where indicated.
 - c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors. or Copper, suitable for terminating copper conductors only or [____].
 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
 - a. Provide means for locking handle in the ON position [where indicated.]
- P. General Duty Switches:
1. Conductor Terminations:
 - a. Provide mechanical lugs.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 2. Provide externally operable handle with means for locking in the OFF position, capable of accepting two padlocks.
- Q. Provide the following features and accessories where indicated or where required to complete installation:
1. Hubs: As required for environment type; sized to accept conduits to be installed.
 2. Integral fuse pullers.
 3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
 4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.
 5. Interlocked Receptacle: Integral pre-wired three phase, three wire, grounded type receptacle interlocked with switch mechanism to prevent insertion or removal of plug with switch in the ON position and to prevent switch from being placed in the ON position without matching plug inserted. Provide receptacle configuration as required to accept [_____]

2.3 FUSIBLE SWITCHES

- A. Fusible switches shall be heavy-duty safety switches with the voltage ratings, current ratings, and number of poles as indicated by the Drawings. The switches shall be horsepower rated. Auxiliary contacts shall be provided as indicated on the Drawings. Stationary contacts shall be equipped with arc chutes. Fuse clips shall accept only Class J current limiting cartridge fuses. Where indicated on the

Drawings, units shall have service entrance labels and shall be equipped with an insulated neutral lug. Switches shall be Square D, Type HD; Eaton Type DH; or equal.

- B. Enclosures shall be as follows:
 - 1. Dry Locations: NEMA Type 1.
 - 2. Corrosive Locations: NEMA Type 4X.
 - 3. Wet locations: NEMA Type 4.
- C. Nameplates: Provide an engraved plastic nameplate for each disconnect switch identifying the equipment it protects.
- D. Fuses:
 - 1. General: Provide one complete set of fuses of each ampere rating shown on the Drawings plus one spare set for each size shown.
 - 2. Fuse Type: Units shall be Class J current limiting, 700 volts, in the ampere ratings shown. Plug fuses are unacceptable. Barrels shall be non-hygroscopic with brass knurled ferrules.
 - 3. Fuses shall conform to UL 248-1 and shall carry labels showing UL class, interrupting rating, time delay characteristics, and voltage rating.

2.4 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.
 - 2. General Electric Company.
 - 3. Square D.
 - 4. Siemens Energy & Automation, Inc.
- B. Type HD, Heavy-Duty, Single Throw, 240 or 600-VAC, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy-Duty, Double Throw, 240 or 600-VAC, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.

3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper conductors.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contacts, arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Accessory Control Power Voltage: As indicated.

2.5 DISCONNECT SWITCHES

- A. Disconnect switches shall be heavy-duty safety switches with the voltage ratings, current ratings, and number of poles as indicated by the Drawings. The switches shall be 600-volt type and horsepower rated. Auxiliary contacts shall be provided as indicated on the Drawings. Switches shall be Square D Type HD; Eaton DH Series; or equal.
- B. Enclosures shall be as follows:
 1. Dry Locations: NEMA Type 1.
 2. Corrosive Locations: NEMA Type 4X.
 3. Hazardous Locations (gases): NEMA Type 7.
 4. Hazardous Locations (dusts): NEMA Type 9.
 5. Wet Locations: NEMA Type 4X.
- C. Nameplates: Provide an engraved plastic nameplate for each disconnect switch identifying the motorized equipment it controls.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Provide required seismic controls in accordance with Section 26 05 48.

- F. Install enclosed switches plumb.
 - G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
 - H. Provide grounding and bonding in accordance with Section 26 05 26.
 - I. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
 - J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
 - K. Identify enclosed switches in accordance with Section 26 05 53.
- 3.3 FIELD QUALITY CONTROL
- A. See Division 01 requirements.
 - B. Inspect and test in accordance with NETA ATS, except Section 4.
 - C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
 - D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.
- 3.4 ADJUSTING
- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- 3.5 CLEANING
- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
 - B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 16.16

SECTION 26 43 00 – SURGE PROTECTIVE DEVICES**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. This Section describes the materials and installation requirements for surge protective devices (SPD). These devices are used to protect AC electrical circuits from the effect of lightning-induced currents, substation switching transients, and internally generated transients resulting from inductive and or capacitive load switching.
 - 1. Surge protective devices for distribution locations.
 - 2. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- B. Section 26 24 13 – Switchboards.
- C. Section 26 24 16 – Panelboards.

1.3 ABBREVIATIONS AND ACRONYMS

- A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.
- B. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. MIL-STD-220 – Method of Insertion Loss Measurement.
 - 2. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 3. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 4. NETA ATS – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
 - 5. NFPA 70 – National Electrical Code.
 - 6. UL 1283 – Standard for Electromagnetic Interference Filters.
 - 7. UL 1449 – Standard for Surge Protective Devices.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Construction Manager of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.6 SUBMITTALS

- A. See Section Division 0126 05 00 – Common Work Results for Electrical for submittal procedures.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
 - 1. SPDs with EMI/RFI filter: Include noise attenuation performance.
- C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- D. Certificates: Manufacturer’s documentation of listing for compliance with the following standards:
 - 1. UL 1449.
- E. Field Quality Control Test Reports.
- F. Manufacturer’s Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- H. Project Record Documents: Record actual connections and locations of surge protective devices.

1.7 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years’ documented experience.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in accordance with manufacturer’s written instructions.

1.9 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer’s required service conditions during and after installation.

1.10 WARRANTY

- A. See Section 01 78 00 – Closeout Submittals, for additional warranty requirements.
- B. Manufacturer’s Warranty: Provide minimum five-year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
- C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 – PRODUCTS**2.1 MANUFACTURERS**

- A. Field-installed, Externally Mounted Surge Protective Devices:
 - 1. ABB/GE.
 - 2. Current Technology; a brand of Thomas & Betts Power Solutions.
 - 3. nVent ERICO.
 - 4. Schneider Electric; Square D Brand Surgelogic Products.
 - 5. Surge Suppression, LLC (SSI).
- B. Factory-installed, Internally Mounted Surge Protective Devices:
 - 1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.
- C. Substitutions: See Division 01.
- D. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.2 SURGE PROTECTIVE DEVICES – GENERAL REQUIREMENTS

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
- B. Unless otherwise indicated, provide factory-installed, internally-mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on the line side of the service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. List and label as complying with UL 1283.
- E. Protected Modes:
 - 1. Wye Systems: L-N, L-G, N-G, L-L.
 - 2. Delta Systems: L-G, L-L.
 - 3. Single Split Phase Systems: L-N, L-G, N-G, L-L.

4. High Leg Delta Systems: L-N, L-G, N-G, L-L.
- F. UL 1449 Voltage Protection Ratings (VPRs):
1. Equivalent to basis of design.
 2. 240/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
- G. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- H. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
1. Switchboards: See Section 26 24 13.
 2. Panelboards: See Section 26 24 16.
- 2.3 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS
- A. Distribution locations include SPDs connected to distribution panelboards.
- B. Surge Protective Device:
1. Protection Circuits: Field-replaceable modular.
 2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
 3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
 4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
 5. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
 - a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
 6. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
 - c. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six-digit LCD display that indicates quantity of surge events.
 7. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.4 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

- A. Surge Protective Device:
1. Protection Circuits: Field-replaceable modular or non-modular.
 2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
 3. Repetitive Surge Current Capacity: Not less than 2,000 impulses.
 4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
 5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the short circuit current rating of the equipment the SPD is connected to, including any series ratings.
 6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
 - a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
 7. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
 - c. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six-digit LCD display that indicates quantity of surge events.
 8. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
- D. Verify system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

- E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.
- E. Provide conductors with minimum ampacity as required by NFPA 70 and not less than manufacturer's recommended minimum conductor size.
- F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Twist conductors together to reduce inductance.
- G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.3 FIELD QUALITY CONTROL

- A. See Division 01 requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS Section 7.19.1.
- D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.4 CLEANING

- A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 43 00

SECTION 26 51 00 – INTERIOR LIGHTING**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Ballasts and drivers.
- D. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- B. Section 26 05 33.16 – Boxes for Electrical Systems.
- C. Section 26 05 53 – Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 09 23 – Lighting Control Devices.
- E. Section 26 27 26 – Wiring Devices: Manual wall switches and wall dimmers.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. IEC 60529 – Degrees of Protection Provided by Enclosures (IP Code).
 - 2. IES LM-63 – Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information.
 - 3. IES LM-79 – Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products.
 - 4. IES LM-80 – Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources.
 - 5. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 6. NECA/IESNA 500 – Standard for Installing Indoor Lighting Systems.
 - 7. NECA/IESNA 502 – Standard for Installing Industrial Lighting Systems.
 - 8. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
 - 9. NEMA LE 4 – Recessed Luminaires, Ceiling Compatibility.
 - 10. NFPA 70 – National Electrical Code.
 - 11. NFPA 101 – Life Safety Code.
 - 12. UL 844 – Luminaires for Use in Hazardous (Classified) Locations.

13. UL 924 – Emergency Lighting and Power Equipment.
14. UL 1598 – Luminaires.
15. UL 8750 – Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.4 SUBMITTALS

- A. See Division 01 01.
- B. Shop Drawings:
 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
 2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
 3. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
 4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
- D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.
- E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Division 01 for additional provisions.
 2. Extra Lenses and Louvers: 2% of total quantity installed for each type, but not less than one of each type.

3. Extra Lamps: 10% of total quantity installed for each type, but not less than two of each type.
 4. Extra Ballasts: 2% of total quantity installed for each type, but not less than one of each type.
- G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.
- 1.5 QUALITY ASSURANCE
- A. Comply with requirements of NFPA 70.
 - B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
 - C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- 1.6 DELIVERY, STORAGE, AND PROTECTION
- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
 - B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- 1.7 FIELD CONDITIONS
- A. Maintain field conditions within manufacturer's required service conditions during and after installation.
- 1.8 WARRANTY
- A. See Division 01 – Closeout Submittals, for additional warranty requirements.
 - B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.
 - C. Provide 5-year pro-rata warranty for batteries for emergency lighting units.
 - D. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 – PRODUCTS**2.1 LUMINAIRE TYPES**

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Division 01.

2.2 LUMINAIRES

- A. Manufacturers:
 1. Acuity Brands, Inc.
 2. Cooper Lighting, a division of Cooper Industries.
 3. Hubbell Lighting, Inc.

4. Lutron Electronics Company, Inc.
 5. Philips Lighting North America Corporation.
 6. Substitutions: See Division 01.
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- F. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- G. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- I. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.
 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
- J. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.
- K. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
 2. Tested in accordance with IES LM-79 and IES LM-80.
 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70% lumen maintenance, calculated based on IES LM-80 test data.
- L. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
1. LED Tape – General Requirements:
 - a. Listed.
 - b. Designed for field cutting in accordance with listing.
 - c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

2. White LED Tape:
 - a. Color Rendering Index (CRI): Not less than 90.

2.3 EMERGENCY LIGHTING UNITS

- A. Manufacturers:
 1. Acuity Brands, Inc .
 2. Cooper Lighting, a division of Cooper Industries .
 3. Hubbell Lighting, Inc .
 4. Substitutions: See Division 01.
- B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source or brownout condition exceeding 20% voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery:
 1. Sealed maintenance-free lead calcium unless otherwise indicated.
 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- F. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- H. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.
- I. Accessories:
 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
 2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
 3. Provide compatible accessory wire guards where indicated.

4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.4 BALLASTS AND DRIVERS

A. Manufacturers:

1. Alloy LED .
2. California Accent Lighting, Inc .
3. General Electric Company/GE Lighting .
4. Lutron Electronics Company, Inc .
5. OSRAM Sylvania, Inc .
6. Philips Lighting North America Corporation .
7. Substitutions: See Division 01.
8. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
9. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Ballasts/Drivers – General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

C. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100% to five% relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
 - a. Wall Dimmers: See Section 26 27 26.
 - b. Daylighting Controls: See Section 26 09 23.
3. Product(s):
 - a. Lutron Hi-Lume Premier 0.1% Constant Voltage (L3D0-Series): three-wire and digital control; 0.1% dimming with Soft-On and Fade-to-Black low end performance.

- b. Lutron Hi-Lume 1% (LTE-Series): Forward phase (neutral wire required); 1% dimming.
- c. Lutron Hi-Lume 1% (L3D-Series): three-wire and digital control; 1% dimming.
- d. Lutron 5-Series (LDE5-Series): Digital control; 5% dimming.
- e. Lutron Hi-lume 1% Soft-on Fade-to-Black (LDE1-Series): Digital control; 1% dimming with Soft-On and Fade-to-Black low-end performance.

2.5 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum ½-inch size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum ¼-inch size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- D. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps where indicated.
- E. Fire-Rated Luminaire Enclosures:
 - 1. Manufacturers:
 - a. Fire Rated Product Specialties Corp .
 - b. Specialty Products & Insulation (SPI); SafeLite .
 - c. Substitutions: See Division 01.
 - 2. Provide as required to preserve fire resistance rating of building elements.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 - 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
 - 4. Secure pendant-mounted luminaires to building structure.
 - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
 - 7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- H. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
 - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Suspended Luminaires:
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
 4. Unless otherwise indicated, support pendants from swivel hangers.
 - J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
 - K. Install accessories furnished with each luminaire.
 - L. Bond products and metal accessories to branch circuit equipment grounding conductor.
 - M. Emergency Lighting Units:
 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
 2. Install lock-on device on branch circuit breaker serving units.
 - N. Exit Signs:
 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
 2. Install lock-on device on branch circuit breaker serving units.
 - O. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.
 - P. Install lamps in each luminaire.
 - Q. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- 3.4 FIELD QUALITY CONTROL
- A. See – Division 01 requirements.
 - B. Inspect each product for damage and defects.
 - C. Operate each luminaire after installation and connection to verify proper operation.
 - D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
 - E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Construction Management/ General Contractor/ Engineer.

3.5 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Construction Management/ General Contractor/ Engineer. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Construction Management/ General Contractor/ Engineer or authority having jurisdiction.
- C. Air-Handling Luminaires with Air Control Blades or Heat Removal Dampers: Adjust as indicated or as required for proper airflow as directed by Construction Management/ General Contractor/ Engineer.
- D. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Construction Management/ General Contractor/ Engineer or authority having jurisdiction.

3.6 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

- A. See Division 01
- B. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

3.9 ATTACHMENTS

- A. Luminaire schedule.

END OF SECTION 26 51 00

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SECTION 27 05 00 – COMMON WORK RESULTS FOR COMMUNICATIONS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. This Section includes the following:
 - 1. Sleeves for pathways and cables.
 - 2. Sleeve seals.
 - 3. Firestopping.
 - 4. Common communications installation requirements.

1.2 REFERENCED STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ANSI C2 – National Electrical Safety Code (NESC).
 - 2. ANSI/EIA/TIA-568-C.0: Generic Communications Cabling for Customer Premises.
 - 3. ANSI/EIA/TIA-568-C.1: Commercial Building Communications Cabling Standards, Part 1: General Requirements.
 - 4. ANSI/EIA/TIA-568-C.2: Balanced Twisted-Pair Communications Cabling and Components Standard.
 - 5. ANSI/EIA/TIA-569-A – Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 6. ANSI/EIA/TIA-606-A – Administrative Standard for Commercial Telecommunications.
 - 7. ANSI/J-STD-607-A – Commercial Building Grounding and Bonding Requirements for Communications.
 - 8. International Code Council (ICC)
 - a. IBC – International Building Code.
 - 9. NFPA 70 – National Electrical Code (NEC).
 - 10. NFPA 101 – Life Safety Code.
 - 11. State Building Code and applicable amendments.
 - 12. State Energy Code.
 - 13. UL (Underwriters Laboratories Inc.)
 - a. UL Compliance: Provide products which are UL-listed and labeled.

1.3 SUBMITTALS

- A. General Description and Requirements

1. In addition to the requirements noted herein, refer to Division 1 for additional requirements. As a minimum, Contractor shall ensure all requirements listed here are met.
2. Within 45 days after award of contract or as dictated by the construction schedule (whichever period of time is shorter), the Contractor shall submit prefabrication submittals consisting of product data and shop drawings for approval. Partial submittals will not be accepted without prior written approval from the Construction Manager.
3. Review of the Prefabrication Submittals by the Construction Manager is for purposes of tracking the work and contract administration and does not relieve the Contractor of responsibility for any deviation from the Contract Documents, or from providing equipment and/or services required by the Contract Documents which were omitted from the prefabrication submittals.
4. No portion of the project shall commence, nor shall any equipment be procured until the prefabrication submittals have been approved in writing by the Construction Manager. All installations shall be in accordance with the Contract Documents.
5. A detailed completion schedule shall be submitted with the prefabrication submittals.
6. Prefabrication submittals shall be accompanied by a letter of transmittal identifying the name of the project, Contractor's name, date submitted for review, and a list of items transmitted.

B. Product Data:

1. **Component List:** Provide complete submittal component list at the beginning of the submittal package. Component list shall identify each component name, manufacturer, and specific product/part number. All part numbers shall clearly indicate special options, color, accessories, etc. Component list and manufacturer cutsheets shall be compiled to match the order of each Appendix.
2. **Cutsheets:** Submit manufacturer's cutsheets on all components listed within this specification and corresponding appendix. All components and parts being used shall be highlighted in color on cutsheets to distinguish specific product/part numbers, options, colors, accessories, etc.
3. **Product Substitutions:** This specification is intended to be performance based, thus all products listed in Appendix 1: Equipment Schedule are benchmark products. The Contractor shall include the listed benchmark product lines in the initial bid as the "base" solution, unless noted otherwise. The Contractor may submit (as a proposed "alternate" solution) substitute manufacturers and models that may be more cost effective or readily available. All substitutions shall meet or exceed the minimum functional, physical, and technical specifications. Acceptance of such substitutions is at the discretion of the Construction Manager. Additionally,

the requirements of Division 1 Specifications shall apply and may supersede requirements noted herein.

C. Prefabrication Shop Drawings:

1. Symbol Legend, Abbreviations, and Description: Provide drawings including descriptions of all abbreviations, symbols, typical mounting heights, project information, etc.
2. One-Line Wiring Diagrams: Include one-line wiring diagrams indicating all backbone and horizontal cabling, copper pair and fiber strand counts, cable quantities, splice enclosures, etc.
3. Site Plan: Provide complete site and exterior plans indicating all site and building façade mounted communication device outlets, equipment, and components proposed to be installed. Additionally, manholes, pull-boxes, and all major raceway routing shall be indicated for conduits 2-inches and larger. Shop drawings shall represent final conduit routing and manhole and/or pull-box placement as coordinated and/or confirmed with Service Provider, Construction Manager, Civil Engineer, and other trades.
4. Floor Plans: Indicating all communication device outlets, equipment, and components proposed to be installed. Floor plans shall indicate cable routing origin and labeling scheme for each cable and termination position. Additionally, major raceway routing shall be indicated for cable trays and conduits 2-inches and larger, based on final coordination with all other trades. Shop drawings shall clearly indicate areas with cable access limitations for review and approval by the Construction Manager.
5. Enlarged Plans: Provide ¼-inch = 1-foot-0-inches enlarged plans of all Equipment Rooms (ER), indicating the position of equipment cabinets, racks, wiring terminals, patch panels, grounding equipment, , copper terminations, and other low voltage systems equipment layout within the rooms. Additionally, shop drawings shall clearly indicate final conduit/riser (core drill and/or block-out) locations and sizes as coordinated and/or confirmed with Structural Engineer and any field conditions that impact proposed location. Shop drawings shall clearly indicate areas where equipment clearances may be limited, for review and approval by the Construction Manager.
6. Details: Including grounding details indicating grounding method for cabinets, racks, cable management,
7. Elevations:
 - a. Rack elevations indicating patch panels, and enclosures, vertical and horizontal cable managers, rack mounted power strips or distribution units, etc.
 - b. Wall elevations of distribution frame with block size, cable routing, cable management, pair counts, method of attachment, etc.

8. Drawing Scale: Shop drawings shall be drawn to scale and completely dimensioned so as to clearly show construction detail.
9. Labeling: Provide documentation of all labeling schemes for conduit, back-boxes, cables, outlets, wiring blocks and/or patch panels, device faceplates, etc.
10. Documentation: Provide a minimum of (1) hardcopy set of prints (in addition to electronic copies) for review or as indicated in Division 1 - General Conditions.

1.4 GENERAL

- A. The term “provide” used throughout this specification and drawings shall mean “furnish, install, test, and certify”.
- B. Coordinate project schedule, installation schedule, phasing and any other requirements deemed necessary with Construction Manager and/or General Contractor and all necessary trades to ensure successful completion of work.
- C. Phasing, temporary distribution/equipment, cutover, and implementation shall be coordinated with the Construction Manager.
- D. Extent of communications raceway infrastructure work is indicated by Division 27 specifications and Technology drawings and schedules and is hereby defined to include, but not by way of limitation, the provisions of:
 1. Raceway systems including but not limited to conduits, cable trays, sleeves, surface raceways, telecommunication services entrance, manholes, pull-boxes, junction boxes, back-boxes, etc. as required and specified in Division 27 sections and select Division 26 sections. The Construction Manager and/or General Contractor shall coordinate this with the Subcontractor performing work and determine how scope of work is assigned. The purpose of this specification is to establish design intent and general system scope.
 2. All communications raceway infrastructure (i.e., pathways and spaces) shall be provided as part of the Base Building Project including:
 - a. Grounding and bonding of all metallic hardware components to the nearest telecommunications grounding bus (TGB) bar including but not limited to equipment racks, cabinets, cable trays, ladder rack, conduits, sleeves, metallic ductwork, and frames.
 - b. Firestopping as required. Contractor shall provide firestopping for all low-voltage openings (including empty low-voltage raceway) once cable installation is complete. Confirm specific firestopping scope requirements with General Contractor and/or Construction Manager.
 - c. Testing of the grounding systems as noted by specification, drawings, and applicable industry standards. Submit written testing results to Construction Manager.

3. Labeling of all communication infrastructure components with mechanically printed labels.
4. Preparation and submission of product data, shop drawings, testing reports, as-built drawings, and cabling documentation as required in this specification.
5. Installation and testing of all system and components.

1.5 ABBREVIATIONS, ACRONYMS, AND TERMS

- A. Provide: Furnish, install, terminate, label, test and certify a complete operating cabling system.
- B. Contract Documents (CD): Design drawings, specifications, sketches, and schedules provided by the Construction Manager as they directly relate to this scope of work and this project.
- C. Structured Cabling Systems (SCS) wiring is defined as all required equipment and cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber cable installed and configured to provide computer data and voice connectivity.
- D. Point-of-Entry (POE): Unmarked Manholes/Vaults at property line.
- E. NET-POP Rooms/MPOE (Main Point of Entry): The area where the outside plant media/carrier services appear in the facility. The NET-POP contains equipment used by owner or carrier to hand-off/transition cable from outside plant into inside plant type.
- F. Network Center/Main Distribution Frame (MDF) Areas: This technology space houses Layer 2/3 network switching gear and other main network distribution equipment and acts as the mid-connection point between the Core/Network and the TR/IDF/access zones for all connections.
- G. Telecommunications Room (TR)/Intermediate Distribution Frame (IDF): is the location for the termination of backbone cables and for termination of horizontal cables, and for the interconnection of each. The space also hosts access-layer switches and user network connections within each floor.
- H. Active Equipment: electronic equipment used to develop various WAN, LAN, and voice services, e.g., digital multiplexers, RS-232 controllers, Ethernet hubs, switches, routers, PBX, etc.
- I. Campus Backbone: Cabling system consisting of media and termination hardware interconnecting POE, Net-Pops, and future onsite buildings.
- J. Building Backbone: cabling system consisting of media and termination hardware interconnecting MDFs to IDFs.
- K. Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the TRs.

- L. Bonding: permanent joining of metallic parts to form an electrically conductive path which will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.
- M. Basket Cable Tray: A cable support and management system fabricated of continuous, rigid, welded steel wire mesh and available in many sizes with attachment hardware suiting multiple installation methods.
- N. Cable Tray: vertical or horizontal open supports, usually made of aluminum or steel, which are fastened to the building structure. Cables are laid in and fastened to the trays.
- O. Cabinet: free standing, floor-mounted or wall-mounted modular enclosure designed to house and protect rack-mounted electronic equipment and passive terminations.
- P. Channel: The end-to-end transmission path between two points at which application specific equipment is connected; encompasses all the elements of the horizontal cabling link, plus the equipment cords in the telecommunications spaces and work area.
- Q. Cross-Connect: equipment used to terminate and tie together communications circuits.
- R. Cross-Connect Jumper: a cluster of twisted-pair conductors without connectors used to establish a circuit by linking two cross-connect termination points.
- S. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.
- T. Jack: receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight-position/eight-contact modular jacks.
- U. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- V. LAN: Local area network.
- W. Link: Horizontal cabling link encompassing all components of the horizontal cabling (TO, patch panels, blocks, jumpers, and patch cords that join them in the horizontal cross-connect). It is distinguished from a channel because it does not include the equipment cables/cords at the telecom spaces or work area.
- X. Media: twisted pair, and fiber optic cable or cables used to provide signal transmission paths.
- Y. Mounting Frame: rectangular steel framework, which can be equipment rack or wall mounted to support wiring blocks, patch panels, and other communications equipment.
- Z. Outside Plant (OSP): generally, any and all portions of the cable system that runs outside of an environmentally enclosed structure and/or building with each end

terminated at different buildings. This specifically includes inter-building cables, conduits, manholes, hand-holes, and innerduct.

- AA. UTP: Unshielded Twisted Pair.
- BB. Passive Equipment: non-electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, patch panels, wiring blocks, fiber optic shelves, etc.
- CC. Pathway: facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, under floor systems, overhead systems, raised floor, ceiling support wires, etc.
- DD. Protectors: electrical protection devices used to limit foreign voltages on metallic communications circuits.
- EE. Raceway: an enclosed channel designed expressly for holding wires or cables; may be of metal or insulating material. The term includes conduit, tubing, wire ways, under floor raceways, overhead raceways, and surface raceways; does not include cable tray.
- FF. Racks: An open, freestanding, floor-mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.
- GG. Riser Backbone: The Riser Backbone subsystem links the main cross connect (MDF) in the equipment room to the distribution rooms (TRs).
- HH. Structured Cabling System (SCS): A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.
- II. Telecommunication Outlet (TO): Connecting device mounted in a work area used to terminate horizontal cable and interconnect cabling with station equipment.
- JJ. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75% or less of the plan area of the surface to support cables.
- KK. Work Area Subsystem: The connection between the telecommunications outlet and the station equipment in the work area is provided by the Work Area Subsystem. It consists of cords, adapters, and other transmission electronics.

1.6 QUALITY ASSURANCE

- A. Manufacturer and Product Qualifications

1. Provide products from manufacturers regularly engaged in the production of communications infrastructure components, including but not limited to, raceway, horizontal copper cabling, copper, , and connecting hardware.
 2. Provide products from manufacturers whose products of similar types, capacities, and characteristics have been in satisfactory use in similar type projects for not less than five years.
- B. Contractor Qualifications:
1. Firms with at least seven (7) years of successful installation experience with projects utilizing communications, raceway, and/or equipment similar to that required for this project.
 2. The company shall have a fully staffed office with technical installations support personnel within the metropolitan area. (Exceptions to this shall be confirmed through approval by the Construction Manager.)
 3. The low-voltage raceway contractor shall be a certified installer (current and in good standing with proven history) of the selected manufacturer's raceway systems and shall provide a 25-year warranty on installation and applications.
- C. All materials shall be Underwriters Laboratories (UL) or Intertek Testing Services (ETL) Listed unless otherwise indicated.
- D. Coordinate with electrical work and other trades to properly interface installation of communications raceway.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver equipment and components in factory-fabricated containers or wrappings, which properly protect equipment from damage.
 - B. Store equipment and components in original packaging. Store inside in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.
 - C. Handle equipment and components carefully to prevent damage. Do not install damaged units or components; replace them with new ones.
- 1.8 SEQUENCING AND SCHEDULING
- A. All work shall be reviewed and coordinated with the Construction Manager and/or General Contractor prior to commencing.
 - B. Communication systems, infrastructure, raceway, and equipment are sensitive to environmental conditions including but not limited to temperature, dirt, dust, and water. The contractor shall ensure the storage and installation of all communication components are sequenced and scheduled accordingly to prevent any damage, loss of performance, and warranty void of such systems. All misinstalled components shall be replaced with new parts and reinstalled at the Contractor's expense.

- C. Coordinate installation with Structural, Electrical, HVAC, Plumbing, Fire Protection, and other trades to eliminate disruption and/or conflict with other systems.
- D. Sequence installation of communications systems and infrastructure with other work to minimize possibility of damage and soiling during remainder of construction.

1.9 PROJECT SITE CONDITIONS

- A. Prior beginning work, the Contractor shall inspect the Contract Documents, and shall become fully informed as to laws, ordinances, and regulations affecting the project. The Contractor shall immediately bring to the Construction Manager's attention, in writing, any existing condition or statute that contradicts, is in conflict with, or negates the Contract Documents. Failure of the Contractor to become fully informed as to all above mentioned items shall in no way relieve the Contractor from any obligations with respect to their proposal.
- B. The Technology Drawings depict equipment locations, backboxes, conduit runs, cabling, etc. in a schematic manner. Field conditions and coordination with related trades may warrant relocations of field devices. No additional compensation will be allowed due to these revisions.

1.10 QUALIFICATIONS

- A. Contractor shall submit a Statement of Qualifications that shall include the following information:
 - 1. Company name, address, telephone number and contact person.
 - 2. Brief company history.
 - 3. Local service capabilities (hours of operation and parts availability).
 - 4. List of references describing three (3) completed projects of similar size and complexity,
 - 5. Licensing information.
 - 6. Copy of manufacturer's certification certificate.

PART 2 – PRODUCTS**2.1 ADDITIONAL REQUIREMENTS:**

- A. Section 26 05 26 – Telecommunications Grounding and Bonding
- B. MANUFACTURERS
- C. Subject to compliance with requirements, manufacturers shall meet all specification requirements and shall be approved by the Construction Manager.

2.2 MATERIALS

- A. Sleeves for Pathways and Cables

1. Steel Pipe Sleeves: ASTM A53/A53, Type E, Grade B, Schedule 40, galvanized steel, plain ends, with plastic bushings.
2. Sleeves for Rectangular Openings: Galvanized sheet steel.
3. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
4. For sleeve cross-section rectangle perimeter equal to more than 50 inches and one or more sides equal to or more than 16 inches, thickness shall be 0.138 inch.
5. Nonmetallic Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to provide consistency suitable for application and a 30-minute working time.

2.3 FIRESTOPPING

- A. Provide materials classified by UL to provide fire barrier equal to time rating of construction being penetrated.
- B. Provide firestopping in all penetrations of fire-rated zones, including floor slabs.
- C. Provide asbestos-free materials that comply with applicable codes and have been tested in accordance with UL 1479 or ASTM E814.
 1. Fire-Rated Cable Pathways: Device modules comprised of steel raceway with intumescent foam pads allowing 0% to 100% cable fill.

PART 3 – EXECUTION

3.1 GENERAL COMMUNICATIONS RACEWAY

- A. Examine areas and conditions under which communications raceway systems are to be installed. Notify the Construction Manager in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
- B. The Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate their work with other trades.
- C. The Contractor shall be responsible for furnishing all materials indicated on the drawings or as specified herein for a complete communications raceway system.
- D. All communications raceway infrastructure shall be installed in an aesthetically pleasing fashion. All surface raceway in new buildings must be approved by the Construction Manager.
- E. All communications raceway infrastructure shall be installed to allow for easy additions, moves, and other changes in the future.

- F. Provide protective cable bushings on all conduits immediately after installation.
- G. Use only electrical 45° or 90° conduit elbows with long bend radii as follows:
 - 1. 6:1 bend radius of the inside conduit diameter for sizes 2 inches or less.
 - 2. 10:1 bend radius of the inside conduit diameter for sizes greater than 2 inches.
- H. Do not place more than two 90° sweeps or exceed 100 feet between pull boxes without providing a pull box.
- I. Fire seal all raceway penetrations and openings to maintain fire rating after communications cables are installed.

3.2 LABELING

- A. All communications components shall be clearly labeled using labeling devices (i.e., handwritten labels are not acceptable) with white label and black text. All labels shall be consistent font type and size (for respective components).
- B. The final labeling scheme shall be coordinated with the Construction Manager prior to finalizing and initiating any work. A sample scheme shall be submitted for approval.

3.3 SERVICE CONTINUITY

- A. Maintain continuity of communications services to all functioning portions of the process or buildings during hours of normal use.
- B. Arrange temporary outages for cutover work with CM. Keep outages to a minimum number and a minimum length of time in order to provide minimum impact.

3.4 LAYOUT AND TOLERANCES

- A. Follow as closely as practicable the schematic design shown on the drawings. Make all necessary measurements in the field to verify exact locations and ensure precise location and fit of specified items in accordance with the drawings. Make no substantial alterations without prior approval of the Construction Manager.

3.5 CABLE TERMINATION AND TEST PLANS

- A. General
 - 1. Provide proof of testing technician(s) certification for operation of the specific units of test equipment, which are proposed for use.
 - 2. Inspection Requirements:
 - a. As part of any performance test, inspect cable, material, and equipment for physical damage, continuity, and proper connection.
 - b. Verify identification and labeling at required locations for visibility, condition, legibility, and accuracy.

3. Test Report Requirements – Each test report shall include the following sections:
 - a. Scope of testing
 - b. List of equipment used in the test with a photocopy of the factory calibration certificate.
 - c. Summary of test results: Hardcopy and electronic copies of the summary forms are to be delivered at conclusion of the project before final payment will be made.
 - d. Cable Termination Plans
 4. Submit detailed termination plans for both fiber optic and twisted pair cables, which describe how each system component will be installed and terminated.
- B. Cable Test Plans
1. Submit detailed test plans for both fiber optic and twisted-pair cable channels which include at least the following information:
 - a. Describe the tests to be performed.
 - b. Explain when and how each system component will be tested.
 - c. List the test equipment to be used.
 - d. Itemize how theoretical loss budgets and test parameters will be calculated and listed.
 - e. Provide an example of the test reporting documentation for each type of test, which provides a written verification of the results, as required in paragraph 2 below.
 2. Provide testing documentation which includes:
 - a. Dates and times of test
 - b. Initial test results
 - c. Description of discrepancies found or failure if any.
 - d. Corrective action if any
 - e. Retest results, if required
 - f. Copy of test equipment calibration certificates
 - g. Intrabuilding (Vertical and Horizontal Subsystem) fiber optic segment post-installation test plan
 3. Twisted-Pair Cable Tests: Testing shall be performed using a minimum Level IIIe tester, approved by the Construction Manager.

3.6 FINAL TEST AND ADJUST

- A. The contractor shall be responsible for post-installation performance testing of all cabling systems specified elsewhere in this Section of the Contract Documents.
1. Testing procedures shall permit recording the length of each link, theoretical loss budget, and tested parameters for each pair and fiber, including space for sign-off by Construction Manager and Owner.
 2. Any cable links or fiber strands, which fail to meet performance test criteria, shall be re-terminated, re-connectorized, or replaced by the Contractor free of charge.
 3. Submit final field test documentation in list form, including the CM signature for Owner's approval.
- B. shielded Twisted-Pair Cable System Testing
1. Permanent Link Test Configuration: Perform metered tests on each multi-pair twisted-pair and/or four-pair UTP cable through the wiring block, patch panel, at each end of the cable section and/or telecommunication outlet (T.O.). The permanent link test shall be undertaken as described in ANSI/TIA-568-C.2-1.
 2. Performance Testing:
 - a. Horizontal Cable System:
 - 1) Use a minimum Level IIIe field test instruments capable of the following swept/stepped frequency voltage measurements in accordance with the performance parameters required by ANSI/TIA-568-C.2-1
 - 2) Test each horizontal link to verify/determine, wire map, length, attenuation, skew, and near-end-crosstalk (NEXT) as described in ANSI/TIA-568-C.2-1.
 - b. Test Reports: Include field test results for each cable including cable link length in accordance with ANSI/TIA-568-C.2-1.
 - c. The test summary shall include:
 - 1) Cable Identification as it appears on cable schedule.
 - 2) Cable identification as it appears on the individual test reports.
 - 3) Cable identification as it is labeled in accordance to the Specifications.
 - 4) Pass/Fail Status.
 - 5) All test parameters shall appear on each test document including graphics and indicating each test parameter result.
 - 6) The individual test data sheet shall include the automated printout produced by the cable scanning equipment.

3.7 CONSTRUCTION REVIEW

- A. The Construction Manager and Owner will review and observe installation work to ensure compliance by the contractor with requirements of the Contract Documents.
- B. The contractor shall inspect, and test completed communications installations to demonstrate specified performance levels including the following:
 - 1. Furnish all instruments and personnel required for the inspections and tests.
 - 2. Demonstrate that the system components operate in accordance with the Contract Documents.
- C. Review, observation, assistance, and actions by the Construction Manager and Owner shall not be construed as undertaking supervisory control of the work or of methods and means employed by the contractor. The Construction Manager and Owner review and observation activities shall not relieve the contractor from the responsibilities of these Contract Documents.
- D. The fact that the Construction Manager and Owner does not make early discovery of faulty or omitted work shall not bar the Owner from subsequently rejecting this work and withholding payment until the contractor makes the necessary corrections.
- E. Regardless of when discovery and rejection are made, and regardless of when the contractor is ordered to correct such work, the contractor shall have no claim against the Construction Manager or Owner for an increase in the Subcontract price, or for any payment on account of increased cost, damage, or loss.

3.8 PROJECT RECORD DOCUMENTS

- A. Provide detailed project record documentation for sections listed in paragraph 1.1.C above, in addition to the standard requirements, within 30 days after completion of the work.
- B. Maintain separate sets of redlined record drawings for the communications work, which show the exact placement, and identification of as-built system components. These are subject to weekly review by the Construction Manager and/or Construction Manager.
- C. Provide communication room record drawings which indicate exact placement for all components; e.g., conduit, wireway, cable tray, backboards, equipment cabinets, equipment racks, and cross-connect equipment, etc.
- D. Provide communication wiring and cabling record drawings and schedules which indicate exact placement, routing, and connection details for all components, e.g., twisted-pair cables, splices, cable cross-connect termination locations, enclosures, telecommunications outlets, and cross-connect jumpers, patch cords, etc.
- E. Provide network schematics when appropriate.

- F. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of comprehensive final schedules for Project.
- G. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for TR/IDFs, backbone pathways and cables, entrance pathways and cables.

3.9 CONTRACTOR REQUIREMENTS

A. General

1. Contractor shall have at least 5 years documented experience installing and testing structured cabling systems of similar type and size.
2. Contractor shall employ at least one BICSI Registered Communication Distribution Designer (RCDD) to sign off on all designs offered, including stamping the design with their current BICSI/RCDD stamp.
3. Contractor shall have all necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.
4. The Telecommunications Contractor shall provide a project manager to serve as the single point of contact to manage the installation, speak for the contractor and provide the following functions:
 - a. Initiate and coordinate tasks with the Construction Manager, Owner, and others as specified by the project schedule.
 - b. Provide day-to-day direction and-site supervision of Contractor personnel.
 - c. Ensure conformance with all contract and warranty provisions.
 - d. Acknowledge and remediate findings of Construction Manager's weekly site project meetings.
 - e. This individual will remain the Contractor's project manager for the duration of the project. The Contractor may change its project manager only with the written approval of Construction Manager.

B. References and Response Times

1. Communication Contractor shall provide a list of four (4) reference accounts where similar data, voice, fiber optic cable, and related equipment installation work was performed within the last year (twelve-month period).

C. Termination of Services

1. Owner reserves the right to terminate the Communication Contractor's services if at any time it is determined the Communication Contractor is not fulfilling their responsibilities as defined within this document and all associated project documentation.

2. Upon termination, the Communications Contractor shall be restricted from the premises and compensated for the percentage of work completed satisfactorily.
 3. Contractor's appearance and work ethic shall be of a professional manner. Dress shall be appropriate to the work being performed.
 4. Conduct on Owner's property will be professional in nature.
- D. Other Contractor Responsibilities
1. Confirmation of Pathway and Cable Manager sizing:
 - a. Wherever cabling pathways or managers are installed, it is the Contractor's responsibility to confirm pathway or manager sizing to represent no more than 25% fill upon installation according to manufacturer's fill tables.
 - b. Pathways deemed overfilled upon installation will not be accepted and shall be remedied at Contractor expense.
 2. Contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job.
 3. All work areas will be cleaned at the conclusion of the project, and no tools or materials shall be left in a manner to pose a safety hazard.
 4. Projects are not considered finished and will not be paid by Owner until all debris, dust, etc. has been cleaned and removed to the satisfaction of Owner.
 5. Contractor shall remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. Removal of orphaned cable is mandatory.
 6. Contractor shall abide by all Owner's security and safety policies pertaining to access and conduct while on Owner's property.
 7. Contractor shall obey all posted speed limits and parking regulations at the Owner's facilities where the work is being performed.
 8. Contractor understands that illegally parked vehicles will be towed, and Contractor is responsible for and will assume all costs associated with towing.

3.10 CLOSEOUT DOCUMENTS

- A. Final closeout documents including, but not limited to, test results on a USB drive, in native tester format, project manual that includes manufacturer and contractor warranties, product cut sheets, material submittals, etc. Also, include the following:
 1. Hard copy documentation of test results for every cable segment and link in 3-ring binder.
 2. Provide "As-Built" Drawings in AutoCAD.

- a. “As-Built” drawings indicating location of all equipment including but not limited to work area outlets, patch panels, cross-connect blocks, on each segment and cable routing outlet and identifiers. Indicate labeling for each piece of equipment.
 - b. As-Built drawings will contain all installed cabling and materials. Outlets will be numbered with each cable associated with the work area outlet.
3. Place a laminated full-size, minimum “C” sized, floor plan of these drawings (coordinate with Owner) on the wall of each communications room, showing area covered, data locations, and cable labeling.

END OF SECTION 27 05 00

SECTION 27 05 33.13 – CONDUIT FOR COMMUNICATIONS SYSTEMS**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Stainless steel rigid metal conduit (RMC).
- C. Galvanized steel intermediate metal conduit (IMC).
- D. Stainless steel intermediate metal conduit (IMC).
- E. PVC-coated galvanized steel rigid metal conduit (RMC).
- F. Liquidtight flexible metal conduit (LFMC).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Inside-plant flexible nonmetallic communications raceway/innerduct.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 33.13 – Conduit for Electrical Systems.
- B. Section 27 10 00 – Structured Cabling.
- C. Division 07

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. ANSI C80.1 – American National Standard for Electrical Rigid Steel Conduit (ERSC).
 - 2. ANSI C80.5 – American National Standard for Electrical Rigid Metal Conduit – Aluminum (ERMC-A).
 - 3. ANSI C80.6 – American National Standard for Electrical Intermediate Metal Conduit.
 - 4. ASTM F512 – Standard Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation.
 - 5. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 6. NECA 101 – Standard for Installing Steel Conduits (Rigid, IMC, EMT).
 - 7. NECA 102 – Standard for Installing Aluminum Rigid Metal Conduit.
 - 8. NECA 111 – Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC).
 - 9. NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

10. NEMA RN 1 – Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit.
11. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit.
12. NEMA TC 3 – Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
13. NFPA 70 – National Electrical Code.
14. TIA-568.0 – Generic Telecommunications Cabling for Customer Premises.
15. TIA-569 – Telecommunications Pathways and Spaces.
16. UL 6 – Electrical Rigid Metal Conduit-Steel.
17. UL 6A – Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel.
18. UL 360 – Liquid-Tight Flexible Metal Conduit.
19. UL 514A – Metallic Outlet Boxes.
20. UL 514B – Conduit, Tubing, and Cable Fittings.
21. UL 651 – Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
22. UL 1203 – Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.
23. UL 1242 – Electrical Intermediate Metal Conduit-Steel.
24. UL 2419 – Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of cables to be installed.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Construction Management of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing

1. Do not begin installation of communications cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

- A. See 27 05 00 – Common Work Results for Communications Systems for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
 - 2. Include proposed locations of roof penetrations and methods for sealing.
- C. Project Record Documents: Record actual routing for conduits installed underground; and conduits 2-inch (53 mm) trade size and larger;

1.6 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 – PRODUCTS**2.1 CONDUIT APPLICATIONS**

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, TIA-569, BICSI ITSIMM, BICSI TDMM, manufacturers' instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements; . Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit;
- C. Underground:
 - 1. Under Slab on Grade: Use rigid PVC conduit;
 - 2. Exterior, Direct-Buried: Use rigid PVC conduit;
 - 3. Where rigid polyvinyl chloride (PVC) conduit; is provided, transition to galvanized steel rigid metal conduit (RMC); stainless steel rigid metal conduit (RMC); where emerging from underground.
 - 4. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth is characterized as severely corrosive based on soils report or local experience; , use corrosion protection tape; or field-applied corrosion protection compound; acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

5. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), emerges from concrete into soil, use corrosion protection tape; or field-applied corrosion protection compound; acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches; on either side of where conduit emerges.
- D. Concealed Above Accessible Ceilings: Use galvanized steel intermediate metal conduit (IMC);
- E. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC)
- F. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC)
- G. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC)
 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets; ,
- H. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC)
- I. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC)
 1. Exterior locations subject to severe physical damage include, but are not limited to:
 - a. Where exposed to vehicular traffic below 20 feet; Complete this?
- J. Corrosive Locations Above Ground: Use stainless steel rigid metal conduit (RMC);
 1. Corrosive locations include, but are not limited to:
 - a. Wastewater treatment facilities.
 - b. Marine environments.
 - c. Chemical storage areas.
- K. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC)
- L. Flexible Connections to Vibrating Equipment:
 1. Dry Locations: Use flexible metal conduit.
 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 3. Maximum Length: 6 feet unless otherwise indicated.
 4. Vibrating equipment includes, but is not limited to:
 - a. Motorized equipment.

2.2 CONDUIT – GENERAL REQUIREMENTS

- A. Comply with NFPA 70 and TIA-569.
- B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
- C. Provide conduit, fittings, supports, and accessories required for complete communications pathway.
- D. Provide products listed, classified, and labeled as suitable for purpose intended.
- E. Maximum Number of Communications Outlet Boxes per Continuous Conduit Homerun: **One**;
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Communications Outlet Box: ¾-inch;
 - 2. Continuous Conduit Homerun Serving One Communications Outlet Box: 1-inch
- G. Where conduit size is not indicated, size to comply with NFPA 70, TIA-569, and BICSI TDMM, but not less than applicable minimum size requirements specified. Where specified standards differ, comply with most stringent.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International.
 - 2. Nucor Tubular Products.
 - 3. Western Tube, a division of Zekelman Industries.
 - 4. Wheatland Tube, a division of Zekelman Industries.
 - 5. Substitutions: See Section 01 60 00 – Product Requirements;
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B.
 - b. Allied Tube & Conduit, a division of Atkore International.
 - c. Bridgeport Fittings Inc.
 - d. Emerson Electric Co; O-Z/Gedney.
 - e. Substitutions: See Section 01 60 00 – Product Requirements;
 - 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.

3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use steel; malleable iron
 - a. Where not subject to severe corrosive influence, stainless steel or aluminum; fittings may be used.
 - b. Do not use die-cast zinc fittings.
5. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted;
6. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Manufacturers:
 - 1) Madison Electric Products, a division of Southwire Company.
 - 2) Substitutions: See Section 01 60 00 – Product Requirements;
 - b. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.4 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 1. Calbrite, a division of Atkore International.
 2. Gibson Stainless & Specialty, Inc.
 3. Patriot Industries, a division of Patriot Aluminum Products, LLC.
 4. Substitutions: See Section 01 60 00 – Product Requirements;
- B. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.
- C. Fittings:
 1. Manufacturers:
 - a. Calbrite, a division of Atkore International.
 - b. Eaton.
 - c. Gibson Stainless & Specialty, Inc.
 - d. Patriot Industries, a division of Patriot Aluminum Products, LLC.
 - e. Substitutions: See Section 01 60 00 – Product Requirements;
 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.

4. Material: Use stainless steel with corrosion resistance equivalent to conduit.
5. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted;
6. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.5 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International.
2. Nucor Tubular Products.
3. Western Tube, a division of Zekelman Industries.
4. Wheatland Tube, a division of Zekelman Industries.
5. Substitutions: See Section 01 60 00 – Product Requirements;

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:

1. Manufacturers:
 - a. ABB; T&B.
 - b. Allied Tube & Conduit, a division of Atkore International.
 - c. Bridgeport Fittings, LLC.
 - d. Emerson Electric Co; O-Z/Gedney.
 - e. Substitutions: See Section 01 60 00 – Product Requirements;
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted;
5. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Manufacturers:
 - 1) Madison Electric Products, a division of Southwire Company.
 - 2) Substitutions: See Section 01 60 00 – Product Requirements;

- b. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.6 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International.
2. Nucor Tubular Products.
3. Western Tube, a division of Zekelman Industries.
4. Wheatland Tube, a division of Zekelman Industries.
5. Substitutions: See Section 01 60 00 – Product Requirements;

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:

1. Manufacturers:

- a. ABB; T&B.
- b. Allied Tube & Conduit, a division of Atkore International.
- c. Bridgeport Fittings, LLC.
- d. Emerson Electric Co; O-Z/Gedney.
- e. Substitutions: See Section 01 60 00 – Product Requirements;

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.

3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.

4. Material: Use steel or malleable iron;

- a. Where not subject to severe corrosive influence, stainless steel or aluminum; fittings may be used.
- b. Do not use die-cast zinc fittings.

5. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted; threaded or threadless fittings;

6. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.

a. Manufacturers:

- 1) Madison Electric Products, a division of Southwire Company.
- 2) Substitutions: See Section 01 60 00 – Product Requirements;

- b. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.7 STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 1. Calbrite, a division of Atkore International.
 2. Substitutions: See Section 01 60 00 – Product Requirements;
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 1. Manufacturers:
 - a. Calbrite, a division of Atkore International.
 - b. Eaton.
 - c. Substitutions: See Section 01 60 00 – Product Requirements;
 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 4. Material: Use stainless steel with corrosion resistance equivalent to conduit.
 5. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted; threaded or threadless fittings
 6. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.8 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 1. ABB; Ocal.
 2. Calbond, a division of Atkore International.
 3. Robroy Industries.
 4. Substitutions: See Section 01 60 00 – Product Requirements;
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.
- D. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch.

- E. PVC-Coated Boxes and Fittings:
 - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 - 2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
 - 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 - 4. Material: Use steel or malleable iron.
 - 5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.
 - 6. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch.
 - 7. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.
 - F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.
- 2.9 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)
- A. Manufacturers:
 - 1. AFC Cable Systems, a division of Atkore International.
 - 2. Electri-Flex Company.
 - 3. International Metal Hose.
 - 4. Substitutions: See Section 01 60 00 – Product Requirements;
 - B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel or; flexible metal conduit listed and labeled as complying with UL 360.
 - C. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B.
 - b. Bridgeport Fittings, LLC.
 - c. Emerson Electric Co; O-Z/Gedney.
 - d. Substitutions: See Section 01 60 00 – Product Requirements
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel
 - a. Do not use die-cast zinc fittings.

4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Manufacturers:
 - 1) Madison Electric Products, a division of Southwire Company.
 - 2) Substitutions: See Section 01 60 00 – Product Requirements
 - b. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
 1. ABB; Carlon.
 2. Allied Tube & Conduit, a division of Atkore International.
 3. Cantex Inc.
 4. Heritage Plastics, a division of Atkore International.
 5. JM Eagle.
 6. Substitutions: See Section 01 60 00 – Product Requirements;
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651 Schedule 80 unless otherwise indicated;
- C. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
 3. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Manufacturers:
 - 1) Madison Electric Products, a division of Southwire Company.
 - 2) Substitutions: See Section 01 60 00 – Product Requirements;
 - b. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.11 ACCESSORIES

- A. Inside-Plant Fabric Innerduct: Listed as complying with UL 2024; plenum rated
 1. Manufacturers:
 - a. Maxcell Innerduct.

- b. Substitutions: See Section 01 60 00 – Product Requirements
- B. Outside-Plant Fabric Innerduct: Designed for installation in underground raceways.
 - 1. Manufacturers:
 - a. Maxcell Innerduct.
 - b. Substitutions: See Section 01 60 00 – Product Requirements
- C. Corrosion Protection Tape: PVC-based, minimum thickness of 10 mil, 0.010 inch
- D. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- E. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- F. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- G. Adhesive for HDPE and RTRC Conduit:
 - 1. Specifically designed for bonding dissimilar materials in lieu of transition fittings, including but not limited to polyethylene, fiberglass, PVC, aluminum, and steel; UL 746C recognized.
 - 2. Approved by adhesive manufacturer for use with materials to be joined.
- H. Pull Strings: Use tape with average breaking strength of not less than 1,250 lbf;
- I. Foam Conduit Sealant:
 - 1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
 - 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 - 3. Rated to hold minimum of 10 ftwater head pressure.
- J. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.
- K. Sealing Systems for Concrete Penetrations:
 - 1. Sleeves: Provide water stop ring or cement coating that bonds to concrete; to prevent water infiltration.
- L. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- M. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

- N. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- O. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

PART 3 – EXECUTION**3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Unless otherwise approved, do not route exposed conduits:
 - a. Across floors.
 - b. Across top of parapet walls.
 - c. Across building exterior surfaces.
 - 4. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 5. Arrange conduit to provide no more than equivalent of two 90-degree bends between pull points.
 - a. The equivalent of three 90-degree bends between pull points is permitted only under conditions described in BICSI TDMM.
 - 6. Arrange conduit to provide no more than 100 feet pull points.
 - 7. Arrange conduit to provide minimum bend radii in accordance with BICSI TDMM.
 - 8. Route conduits above water and drain piping where possible.
 - 9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 10. Maintain recommended separation from sources of EMI greater than 5 kVA in accordance with BICSI ITSIMM and BICSI TDMM.

11. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
12. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to: _____ .
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
13. Group parallel conduits in same area on common rack.

E. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction.
2. Provide required seismic controls.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use metal channel/strut with accessory conduit clamps; to support multiple, parallel, surface-mounted conduits.
6. Use conduit clamp; to support single conduit from beam clamp or threaded rod.
7. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
8. Use of wire for support of conduits is not permitted
9. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements; comply with NFPA 70; or _____ .

F. Connections and Terminations:

1. Use approved zinc-rich paint; on field-cut threads of galvanized steel conduits prior to making connections.
2. Use suitable adapters where required to transition from one type of conduit to another.
3. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs; for dry locations and raintight hubs; for wet locations.

5. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect cables.
 6. Secure joints and connections to provide mechanical strength and electrical continuity.
- G. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves and/or slots for penetrations as indicated or as required to facilitate installation.
 4. Conceal bends for conduit risers emerging above ground.
 5. Provide suitable sealing system; where conduits penetrate exterior wall below grade.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
 9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00;
- H. Underground Installation:
- I. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed cables or connected equipment. This includes, but is not limited to:; _____ .
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where conduits are subject to earth movement by settlement or frost.
- J. Conduit Sealing:
1. Use foam conduit sealant; to prevent entry of moisture and gases. This includes, but is not limited to:; _____ .
 - a. Where conduits enter building from outside.

- b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.
 - 2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant; at accessible point near penetration to prevent condensation. This includes, but is not limited to:;
_____ .
 - a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
 - 3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings; as approved by authorities having jurisdiction; locate as indicated or in accordance with NFPA 70.
 - K. Provide pull string in each empty conduit and innerduct/cell, and in each conduit where cables are to be installed by others. Leave minimum slack of 12 inches; at each end.
 - L. Provide grounding and bonding.
 - M. Identify conduits.
- 3.3 FIELD QUALITY CONTROL
- A. See Section 01 40 00 – Quality Requirements for additional requirements.
 - B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
 - C. Correct deficiencies and replace damaged or defective conduits.
- 3.4 CLEANING
- A. Clean interior of conduits to remove moisture and foreign matter.
- 3.5 PROTECTION
- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of cables.

END OF SECTION 27 05 33.13

SECTION 27 10 00 – STRUCTURED CABLING**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Copper cable and terminations.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
 - 1. Includes intersystem bonding termination.
 - 2. Includes bonding jumpers for bonding of communications systems and electrical system grounding.
- B. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- C. Section 26 05 33 – Raceways and Boxes for Electrical Systems.
- D. Section 26 05 53 – Identification for Electrical Systems: Identification products.
- E. Section 27 05 33.13 – Conduit for Communications Systems.
- F. Section 26 27 26 – Wiring Devices.

1.3 REFERENCE STANDARDS

- A. The publications listed below form a part of this Specification to the extent referenced. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.
 - 1. FM (AG) – FM Approval Guide.
 - 2. NFPA 70 – National Electrical Code.
 - 3. TIA-568 (SET) – Commercial Building Telecommunications Cabling Standard Set.
 - 4. TIA-568.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
 - 5. TIA-569 – Telecommunications Pathways and Spaces.
 - 6. TIA-606 – Administration Standard for Telecommunications Infrastructure.
 - 7. TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
 - 8. UL 444 – Communications Cables.
 - 9. UL 514C – Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
 - 10. UL 1863 – Communications-Circuit Accessories.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate with the HVAC vendor and contractor on site.

2. Notify Construction Management of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 27 05 00 – Common Work Results for Communications Systems for submittal procedures.
- B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for each product.
- C. Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 15 days prior to intended test date.
- D. Field Test Reports.

1.6 QUALITY ASSURANCE

- A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- B. Manufacturer Qualifications: At least 3 years of experience manufacturing products of the type specified.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer’s unopened packaging until ready for installation.
- B. Keep stored products clean and dry.

1.8 WARRANTY

- A. Correct defective Work within a 2-year period after Date of Substantial Completion.

PART 2 – PRODUCTS**2.1 PATHWAYS**

- A. Conduit: See section 27 05 33.13.
- B. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
 1. Products:
 - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built.
 - b. Substitutions: See Section 01 60 00 – Product Requirements

2.2 COPPER CABLE AND TERMINATIONS

- A. Manufacturers:
 - 1. CommScope.
 - 2. General Cable Technologies Corporation.
 - 3. Siemon Company.
 - 4. Substitutions: See Section 01 60 00 – Product Requirements
- B. Copper Backbone Cable:
 - 1. Description: 100-ohm, balanced twisted pair cable complying with TIA-568.2, ICEA S-90-661, and listed and labeled as complying with UL 444; arranged in 25-pair binder groups.
 - 2. Cable Type: TIA-568.2 Category 5e UTP (unshielded twisted pair); 24 AWG.
 - 3. Cable Capacity: Four-pair.
 - 4. Cable Applications:
 - a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
 - b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
- C. Copper Horizontal Cable:
 - 1. Description: 100-ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
 - 2. Cable Type –Data: TIA-568.2 Category 6 UTP (shielded twisted pair); 23 AWG.
 - 3. Cable Capacity: 4-pair.
 - 4. Cable Applications:
 - a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
 - b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
 - c. General Purpose Applications: Use listed NFPA 70 Type CMP plenum cable.
 - 5. Cable Jacket Color Data Cable: Blue.
 - 6. Cable Jacket Color – Voice Cable: Product(s):
 - a. CommScope; SYSTIMAX Twisted Pair Cables; GigaSPEED XL Category 6 U/UTP Cable.
 - b. CommScope; Uniprise Twisted Pair Cables; CS34 Series Category 6 U/UTP Cable.

- c. General Cable Technologies Corporation; GenSPEED Cables.
 - D. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.
 - E. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
 - 1. Performance: 500; mating cycles.
 - 2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
 - 3. Product(s):
 - a. CommScope; SYSTIMAX RJ45 Jacks; MGS400 Series Category 6 U/UTP Modular Jacks
 - b. CommScope; Uniprise RJ45 Jacks; UNJ600 Series Category 6 U/UTP Modular Jacks
- 2.3 GROUNDING AND BONDING COMPONENTS
- A. Comply with TIA-607.
 - B. Comply with Section 26 05 26
- 2.4 IDENTIFICATION PRODUCTS
- A. Comply with TIA-606.
 - B. Comply with Section 26 05 53.
- 2.5 SOURCE QUALITY CONTROL
- A. See Section 01 40 00 – Quality Requirements, for additional requirements.
 - B. Factory test cables according to TIA-568 (SET).

PART 3 – EXECUTION**3.1 INSTALLATION – GENERAL**

- A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.
- B. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.
- C. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

3.2 INSTALLATION OF PATHWAYS

- A. Install pathways with the following minimum clearances:
 - 1. 48 inches from motors, generators, frequency converters, transformers, and uninterruptible power systems.

2. 12 inches from power conduits, cables, and panelboards.
 3. 5 inches from fluorescent and high frequency lighting fixtures.
 4. 6 inches from flues, hot water pipes, and steam pipes.
- B. Outlet Boxes:
1. Coordinate locations of outlet boxes provided under Section 26 05 33.16; as required for installation of telecommunications outlets provided under this section.
- 3.3 INSTALLATION OF EQUIPMENT AND CABLING
- A. Cabling:
1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
 2. Do not over-cinch or crush cables.
 3. Do not exceed manufacturer's recommended cable pull tension.
 4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
- B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames: 120 inches.
 2. At Outlets – Copper: 12 inches.
 3. At Outlets – Optical Fiber: 39 inches.
- C. Copper Cabling:
1. Category 5e and Above: Maintain cable geometry; do not untwist more than ½ inch from point of termination.
 2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
- D. Identification:
1. Use wire and cable markers to identify cables at each end.
 2. Use manufacturer-furnished label inserts or engraved wall plate to identify each jack at communications outlets with unique identifier.
- 3.4 FIELD QUALITY CONTROL
- A. See Section 01 40 00 – Quality Requirements for additional requirements.
- B. Comply with inspection and testing requirements of specified installation standards.
- C. Visual Inspection:
1. Inspect cable jackets for certification markings.

2. Inspect cable terminations for color coded labels of proper type.
 3. Inspect outlet plates and patch panels for complete labels.
 4. Inspect patch cords for complete labels.
- D. Testing – Copper Cabling and Associated Equipment:
1. Test backbone cables after termination but before cross-connection.
 2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
 3. Test operation of shorting bars in connection blocks.
 4. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
 5. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.
- E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION 27 10 00

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SECTION 40 61 13 PROCESS CONTROL SYSTEM GENERAL PROVISIONS**PART 1 – GENERAL****1.1 DESCRIPTION OF WORK**

- A. This section specifies the components of the instrumentation and control system including control panel(s) and the general requirements for the construction and arrangement of the associated equipment and field instrumentation.
- B. Work and materials specified in this section include:
 - 1. PLC Remote I/O control cabinet, I/O, and associated equipment and instrumentation.
 - 2. Field Instrumentation, installation and calibration requirements.
 - 3. Shop and field testing, and calibration of power & control system components and equipment.

1.2 SYSTEM DESCRIPTION

- A. Provide one (1) PLC based control panel with Allen Bradley CompactLogix Remote I/O for HVAC control panel PNL 7200 for equipment control, monitoring and alarming.
- B. Provide field instrumentation and control devices and installation details.
- C. Coordinate and implement controls for motor controllers.

1.3 SYSTEM INTEGRATOR

- A. The System Integrator is responsible for the final design and assembly of the instrumentation and control system and control panels.
- B. Select one System Integrator.
 - 1. The following are acceptable companies:
 - a. Systems Interface – Mukilteo, Washington.
 - b. Quality Controls - Lynnwood, Washington.
 - c. Technical Systems, Inc. - Lynnwood, Washington.
 - 2. The System Integrator must have at least one full time programmer at the proposed site of the factory test.
 - 3. The System Integrator must fabricate and assemble the panel at the location where factory test is performed.
 - 4. The System Integrator's facility for this work must be within a 75-mile radius of the Job Site.
- C. All programming of the PLC and operator interface shall be by the System Integrator.

- D. The System Integrator shall be responsible for the final design and assembly of the entire I&C system.
 - 1. The system shall be designed to provide the control capabilities and functions indicated and implied by the plans and these specifications and to provide trouble-free operation with minimum maintenance.
 - 2. The system shall readily enable manual operation of any and all functions in the event of failure of any one component.

1.4 STANDARDS AND CODES

- A. All equipment and materials shall conform to the latest revised editions of applicable standards published by the following organizations:
 - 1. American National Standards Institute (ANSI)
 - 2. Institute of Electrical and Electronic Engineers (IEEE)
 - 3. National Electrical Manufacturer's Association (NEMA)
 - 4. Underwriters' Laboratories (U/L)
 - 5. Instrument Society of America (ISA)
- B. All electrical equipment and materials, and the design, construction, installation, and application thereof shall comply with all applicable provisions of the National Electrical Code (NEC), the Occupational Safety and Health Act (OSHA), and any applicable Federal, State, and local ordinances, rules and regulations.
- C. All materials and equipment specified herein shall within the scope of UL examination services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- D. All control panels shall bear a label by UL or by a Washington State Department of Labor and Industries approved testing agency for the suitability of the assembled panel.

1.5 SHOP DRAWINGS

- A. General Requirements:
 - 1. Conform to the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions.
 - 2. Arrangement drawings shall be drawn to scale using standard Architectural or Engineering scales.
 - 3. Shop drawings shall be provided on sheets no larger than 11 inch X 17 inch. Shop drawings shall include specific product detail such as rating, size, and number of contacts, etc. Wiring diagrams shall be included for all components in the system including control equipment supplied with mechanical devices.
 - 4. For shop drawing packages provide the drawings in a separate 11 inch X 17 inch binder with an index for the drawings at the front.

- B. The System Integrator shall develop any shop drawings required for design, fabrication, assembly and installation of the power and control panels. Shop drawings shall include all drawings required in manufacture of specialized components and for assembly and installation of them. Shop drawings shall include detailed “end-to-end” control wiring diagrams showing all interface of field equipment and instrumentation. In addition, the following drawings shall be provided:
1. Control Cabinet Layout Drawings: The System Integrator shall develop shop drawings for the control cabinets and wiring and terminals within the control cabinets to show all details of the control system. Drawings shall include scaled drawings of both interior and exterior elevation views. All components shall be identified by both the nameplate information and also the component number related to the bill of materials.
 2. Equipment and Instrument Wiring Diagrams: The System Integrator shall provide individual wiring diagrams (one drawing) for each field instrument and for each controlled motor load. All wiring interface for each instrument or equipment shall be shown on a single drawing* and the drawing shall be titled with the equipment or instrument name and number. Each drawing shall include field devices, PLC I/O and motor control, etc. associated with that instrument or equipment. Include all terminals, terminal numbers, wire numbers (both internal and field), PLC I/O and memory address, and equipment TAG number.

** for instruments of the same type - if space allows then more than one instrument of the same exact type may be shown on a single drawing. This exception applies for instruments only, not for equipment.*
 3. Card Drawings: The System Integrator shall provide the information for each input and each output of the PLC on “PLC Card drawings”. All details of each card must be shown on a single drawing – one I/O card per drawing*. Each I/O point shall be designated with the memory address, point id tag number, point description and wiring diagram reference drawing number.

**cards of the same type – if space allows, then more than one card of the same exact type may be shown on a single drawing.*
 4. Terminal Arrangement Drawings: Provide terminal layout drawings that show the layout of all terminals in the cabinet.
- C. Shop drawings shall be drawn in AutoCAD and include the following:
1. Technical data sheets for all components with the complete part number of the component clearly designated with all required options.

2. Arrangement drawings of all cabinet front-mounted and internal-mounted instruments, switches, devices, and equipment indicated. Show all panel mounting details required. Include outer dimensions of all panels on the drawing. Deviations from approved arrangements require resubmittal and approval prior to installation.
- D. Installation details shall include the size, number, type and location of interconnecting wiring and conduit, installation of cabinets and enclosures, installation of sensors, instruments, limit switches, and other installation requirements. Shop drawings shall be submitted to Construction Management/Engineer for review and approval.
- 1.6 SUBMITTALS
- A. In accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions, and Section 26 00 00, Electrical General, submit the following:
1. Index and identify the submittals as follows:
 - a. Cover sheet with:
 - 1) the project name and submittal #.
 - 2) Contractor's and subcontractor's name, phone number, and email address.
 - 3) List of deviations from specified components.
 2. Per the general submittal requirements in other sections of this specification and the following. The System Integrator shall develop and shall submit to the Construction Management/Engineer the following project data:
- B. Provide one PDF document with two sections; one section with all product data and a second section with all shop drawings.
1. All products shall be included in a single PDF document including the cover sheet and index and bill of materials (BOM).
 - a. Index the PDF document to show each individual product in the bookmarks of the PDF.
 - b. BOM bill of materials showing each product being submitted.
 - c. PDF index tabs per the electrical specifications by section and paragraph or equipment name e.g. provide a minimum of one tab section for each piece of equipment in all of the PART 2 PRODUCT.
 - d. Cut sheets for all products with a BOM - Bill of materials showing quantity, Manufacturer, catalog number, and the supplier name and phone number and relevant spec. paragraph number. Number each item in the bill of materials and relate the bill of materials to the submitted product index.

- e. Provide a listing of all spare parts to be provided.
- 2. Shop drawings shall be included in a single PDF document including the cover sheet and index in one single document.
 - a. A detailed project schedule relating specifically to I&C – showing submittals, review time, long lead equipment, panel fabrication, expected site delivery date – startup, etc. Highlight any anticipated critical path tasks. Provide a copy with the submittal and e-mail in PDF.
 - b. All shop drawings: provide an electronic copy, in AutoCAD dwg format of all shop drawings on a flash jump drive or other transmission means to the Owner. Include the AutoCAD dwg drawing with the following submittals:
 - 1) Approval submittals,
 - 2) Revised approval submittals (if needed), and
 - 3) Final as-built drawings.
 - c. I/O checklist that verifies that all control and status/indication points in the control panels both implemented and spare have been tested. One copy of the I/O Checklist shall be submitted for the start of the Factory Test. One copy of the I/O Checklist shall be submitted prior to the Control system startup. The PLC Card drawings shall be used for this purpose.
 - d. Provide reference numbering on all cut sheets to relate them to the bill of materials. Provide same reference numbering by the equipment shown on the shop drawings.

1.7 COORDINATION WITH OTHER EQUIPMENT

- A. The System Integrator shall be responsible for obtaining all necessary information/product data (wiring diagrams, load data, etc.) for other equipment and instrumentation used in the project that requires integration into the power and control system – even for equipment and instrumentation outside the System Integrator’s scope of supply. This may include, but is not limited to (standby generator, ATS, flow transmitters and other instrumentation, control valves, motor data, etc.).
- B. System wiring diagrams shall include information from other equipment.
- C. See PART 4 of this Section for additional requirements.

1.8 NAMEPLATES

- A. Nameplates shall be provided on all electrical devices – (equipment, instruments, boxes, etc.).

- B. Nameplates shall also be provided on all electrical panel interior and exterior equipment (including but not limited to: relays, I/O cards, circuit breakers, power supplies, terminals, contactors, switches, indicating lights, buttons, meters, and other devices.).
- C. Equipment nameplates shall have both the equipment name and number and equipment circuit number (if applicable).
- D. Instrument Nameplates: Provide nameplates for all instruments with instrument name, number, and the circuit (ckt) breaker, or fuse location for the power source. For nameplates that cannot be attached to the instrument provide a stainless steel cable ring to attach it to the instrument.
- E. Nameplates shall be made of 1/16 inch thick machine engraved laminated phenolic having black letters not less than 3/16 inch high on white background or as shown on the Drawings or other sections of the specifications. Nameplates on the interior of panels shall be White Polyester with printed thermal transfer lettering and permanent pressure sensitive acrylic; TYTON 822 or accepted equal. All nameplates shall include the equipment name and number (and function, if applicable).
- F. Relays shall be provided with two (2) nameplates, one on the backpan by the relay base and one on the face of the relay.
- G. Provide warning nameplates on all panels and equipment which contain multiple power sources. Provide nameplates describing locations of power sources and disconnects. Provide any other warning or information nameplates as required by NEC or UL.
- H. Nameplates shall be secured to equipment with stainless steel screws/fasteners. Epoxy glue or other quality adhesive may be used where fasteners are not practical if first approved by the Engineer (submitted via Construction Management).

PART 2 – PRODUCTS**2.1 GENERAL**

- A. Design and Assembly:
 - 1. All equipment and materials utilized in the system shall be the products of reputable, experienced manufacturers with at least five (5) years' experience in the manufacture of similar equipment. Similar items in the system shall be the products of the same manufacturer.
 - 2. All equipment shall be of industrial grade and of standard construction, shall be capable of long, reliable, trouble-free service, and shall be specifically intended for control and monitoring of operation of motor-driven pumps and equipment.

3. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing. All equipment, where practical, shall be of solid state, integrated circuit design.
4. The system shall be completely assembled in the shop by the System Integrator. All components and equipment shall be prewired to the maximum extent possible.
5. All components, including both internally and face-mounted instruments and devices, shall be clearly identified with phenolic nameplates of black background with white letters. Nameplates on the interior of panels shall be White Polyester with printed thermal transfer lettering and permanent pressure sensitive acrylic; TYTON 822 or accepted equal.
6. Provide enclosures in accordance with 40 61 13.

2.2 INSTRUMENTATION

A. General Requirements of Instrumentation:

1. All Instruments, switches and control sensors shall be rated for the environment in which they will be located. In general, devices mounted indoors shall be NEMA 12 rated. Devices mounted outdoors, or in wet or corrosive environments shall be NEMA 4X rated.
2. Devices mounted in hazardous areas shall be rated for the classification of the area that they are located.
 - a. Provide barriers, intrinsically safe relays, explosion proof boxes, or other equipment, if necessary, to rate equipment for the environment installed.
 - b. Provide seal fittings per NEC.
3. Transmitters shall be indicating type when available and shall have local or direct reading indicators, unless otherwise shown.
 - a. Provide a pressure gauge for every pressure switch and transmitter.
4. Select range of instruments for the application.
5. Transmitter input power shall be 120VAC 60HZ unless otherwise shown, output shall be 4-20 mA into a minimum 500-ohm load.
6. For each instrument that has a separate power source, provide a power disconnect switch (rated for the environment and the application) mounted next to each instrument.
7. Transmitters located outdoors shall be provided in an enclosure with a heater or provided with thermostat controlled heaters in their enclosure.
8. Instruments shall automatically reset and resume normal operation after power interruption without manual resetting.

9. Instrument cords (for example: cords between the sensor and the transmitter) shall be provided:
 - a. With length sufficient for the application.
 - b. With rating for the environment installed.
 10. Terminate all wiring on terminal strips, splicing wiring is not acceptable.
 11. Wire that terminates on screw type terminals shall be provided with a spade or loop type end connector.
 12. For all indicating transmitters that are mounted inside enclosures, provide a window in the enclosure so that the display can be viewed without opening the enclosure.
 13. Instrumentation supplier shall provide installation inspection, calibration and training as required for proper installation.
- B. Door-Switches:
1. Provide door security switches at locations indicated on the Drawings. Switches shall be limit switches with lever arm as required for the application Square D class 9007 or accepted equal. Install such that the switch contacts are closed when the door is closed.
- 2.3 WIRE MARKERS:
- A. Field installed wire markers shall be T&B, SHRINK-KON HVM or accepted equal.
- 2.4 SPARE PARTS
- A. In addition to spare parts mentioned elsewhere in this section, the Contractor shall supply the following spare parts for use by the Owner. All spare parts shall be shipped with the equipment.
 1. Qty one (1) spare (non-installed) PLC input and output card of each type used.
 2. Qty one (1) spare power supply of each type and rating used.
 3. Qty one (1) relay of each type used or 10 % whichever is the greater amount.
 4. Qty three (3) lamps of each type used or 100% whichever is the greater amount.
 5. Qty 200% spare fuses (two spare fuses for each fuse supplied).
 6. Provide 10 spare nameplates 3 inch square or less with 20 letters ½ inch or less to be specified by the Owner.
 7. Qty one (1) copy of final PLC program on a thumb drive. Final PLC program copy to include annotation and descriptors.

PART 3 – EXECUTION**3.1 INSTALLATION****A. General:**

1. The instrumentation and control system shall be installed, in accordance with the Drawings, installation details, and also instructions prepared by the System Integrator, and per special instruction from equipment or instrumentation Manufacturers.
2. The Integrator shall provide detailed installation drawings and wiring diagrams for this purpose.
3. Installation shall include all elements and components of the I&C system and all conduit and interconnecting wiring between all elements, components, and sensors.
4. Provide instrument calibration sheets for all instruments to verify function, range, setpoints etc.
 - a. For analog instruments include range information and test at 0, 25%, 50% 75% and 100%. Unless otherwise shown set displays as follows – for level measurement in FEET, for pressure in PSI, for flow GPM.
 - b. For switches verify operation and check setpoint for correct operation – for floats verify trip level, pressure switch settings, etc.

3.2 DISRUPTION OF OPERATIONS

- A. The Contractor must provide all monitoring, control, and power supply for temporary bypass operations. The bypass control and power systems must be successfully tested prior to disabling or removing the existing monitoring, control, and power supply system.
- B. The Contractor must prevent damage, including equipment and environmental, caused by failure of equipment. The Contractor must immediately restore controls and power upon disruption of the controls or power of the bypass system.
- C. The Contractor must immediately restore controls and power upon disruption of the controls or power of the new control system.
- D. If a controls disruption occurs during testing, the controls proving must be restarted.

3.3 FACTORY TESTING & INSPECTION

- A. Test the power & control panels prior to delivery to the site.

3.4 STARTUP AND TESTING

- A. Calibrate and configure all components of the control system after completion of installation. Adjust each component to be within the Manufacturer's required range and for the specific application.

- B. Remove and replace components that cannot be properly calibrated or exceed the Manufacturer's specified range or accuracy.
- C. The control system shall be placed into operation by the Contractor and System Integrator.
- D. The Owner will witness testing of all components. Record testing results on check-off forms.

3.5 FIELD TESTING OF THE CONTROL SYSTEM

- A. General:
 - 1. Start field testing when the installation is substantially complete.
 - 2. Demonstrate that all system components connect up correctly to each other so that the system works as designed.
 - 3. Field testing of the control system shall take place in 4 phases.
 - a. Continuity Testing,
 - b. I/O Testing,
 - c. Program Testing, and
 - d. System Validation Testing.
- B. Continuity Testing:
 - 1. As equipment wiring is completed, the Contractor and Hardware Integrator shall perform a continuity test for every control to determine terminal to terminal continuity and verify all control and signal wiring is installed in accordance to the Hardware Integrators wiring diagrams.
- C. I/O Testing:
 - 1. The entire I&C system shall be I/O tested.
 - 2. Prior to calling for I/O testing the Contractor shall:
 - a. Complete the continuity testing.
 - b. Label all wire at both ends.
 - c. Submit all associated test and calibration forms (Instrument, motor, wire, etc.).
 - d. Run all motors (in HAND) to verify correct operation and rotation.
 - e. Provide all equipment and instrument labels per spec.
 - f. Test operation of "packaged sub systems".
 - 3. Prior to any equipment being put into automatic operation, every digital and analog input and output shall be tested for correct operation and witnessed by the Electrical Engineer. The Contractor shall provide a set of the PLC Card drawings and instrument and control wiring diagrams on 8 1/2 inch x

11 inch sheets for a check-off list of all inputs and outputs. If a point cannot be verified within 5 minutes of starting the check that point shall be noted as a punch list item to be corrected and re-tested at a later time.

4. Successfully I/O Tested:
 - a. A piece of equipment of system shall be considered “successfully I/O tested” when all of the I/O for that equipment has been tested and verified by both the programmer and the Electrical Engineer and checked off of the wiring diagrams or PLC I/O card drawings.
 - b. Note: The Electrical Engineer must witness and verify all I/O testing.
 5. Once all I/O associated with a piece of equipment of system has been **successfully tested**, then the equipment or system will be deemed ready for program testing.
 6. Inputs:
 - a. The Contractor shall simulate an actual field condition whenever possible to provide both the digital and analog signal inputs into the PLC and these will be verified by the programmers. Where an actual field simulation is not practical, then the Contractor shall jumper the digital inputs at a point closest to the field device as possible and shall use an analog loop simulator for analog inputs.
 - b. Analog inputs shall be tested at 0, 25%, 50%, and 100% of full range.
 7. Outputs:
 - a. The programmer will simulate outputs from the PLC and the Contractor shall verify the field operation of the output. The field operation verification shall be by actual operation of equipment when possible. When actual field operation of equipment is not practical for verification, then the Contractor shall use volt and amp metering to verify digital and signal outputs.
 - b. Analog outputs shall be tested at 0, 25%, 50%, and 100% of full range.
- D. Program Testing:
1. The Contractor shall provide field support to the programmer for testing of the program. The Contractor shall provide field simulation of equipment as needed by the programmer to test all monitoring and alarm functions of the programming. The Contractor shall anticipate that the program testing will require a minimum of 24 hours of field support time for this project. The cost for this time shall be included in the bid.

E. System Validation Testing:

1. After the program testing is complete, validation testing shall be by the Hardware and Software Construction Management/ Engineer and Contractor, with the Owner/ Construction Management and Engineer present. Validation testing shall include operation and verification of all control components and features of the entire control system.
2. Validation testing shall be done with a closed-loop clean water system for a minimum of 48-hours at each station under varying operating conditions.
3. The Contractor shall simulate various field conditions to test all control operations, monitoring and alarms for all systems and equipment.
4. The Contractor shall inform the Construction Management/ Engineer of the testing schedule at least one week prior to the commencement of testing. Validation testing shall be considered complete when the Owner and Construction Management/ Engineer have determined that all of the original system requirements have been met.
5. The System Integrator shall revise, modify, adjust the system as required during and following start-up to provide the operation required by the contract documents.
6. Note: the Engineer shall not be called out by the Contractor for validation testing on equipment until all components are installed, all wiring points have been checked, and operation has been tested and verified by the Contractor.

3.6 COMMISSIONING

- A. Once all systems have passed validation testing, then the plant will be operated for 2 weeks or time period as determined in the documents to verify plant operations prior to final acceptance.

3.7 SYSTEM MAINTENANCE

- A. The System Integrator shall be responsible for maintenance of the system from time of start-up to the date of acceptance, by formal action of the Owner, of all work under the contract. The System Integrator shall correct deficiencies and defects and make any and all repairs, replacements, modifications, and adjustments as malfunctions or failures occur. The System Integrator shall perform all such work required or considered to be required by the Owner to cause and maintain proper operation of the system and to properly maintain the system.

3.8 SERVICES OF SYSTEM INTEGRATOR

- A. General: An authorized service representative of the control panel System Integrator shall be present at the Site for a minimum of three Days. For the purpose of this paragraph, a Day is defined as a 7-hour period excluding travel time.

- B. Inspection, Startup, Field Adjustment: The authorized service representative shall supervise the following and certify the equipment and controls have been properly installed, aligned, and readied for operation.
1. Installation of the equipment.
 2. Inspection, checking, and adjusting the equipment.
 3. Startup and field testing for proper operation.
 4. Performing field adjustments such that the equipment installation and operation comply with requirements.
- C. Instruction of Owner's Personnel: The authorized representative shall instruct the Owner's personnel in the operation and maintenance of the equipment, including step by step troubleshooting with test equipment. Instruction shall be specific to the equipment models provided. Training shall be scheduled a minimum of 2 weeks in advance of the first session. Training shall include individual two sessions for two (2) shifts of plant personnel (2 hours for each session) at each pump station.
- D. Proposed training materials shall be submitted for review, and comments shall be incorporated. Training materials shall remain with the trainees. The Contractor shall provide professional videotaping of one training session at each pump station for later use with the Owner's personnel. The Hardware Integrator shall conduct specifically organized training sessions in operation and maintenance of the control system for personnel employed by the Owner. The training sessions shall be conducted to educate and train the personnel in maintenance and operation of all components of the control system. Training shall include, but not be limited to, the following:
1. Preventative maintenance procedures.
 2. Trouble-shooting.
 3. Calibration.
 4. Testing.
 5. Replacement of components.
 6. Automatic mode operation.
 7. Manual mode operation.

3.9 OPERATION AND MAINTENANCE DATA

- A. The System Integrator shall prepare and assemble detailed operation and maintenance manuals in accordance with the project general requirements. The manuals shall include, but not be limited to, the following:
1. Preventative maintenance procedures.
 2. Trouble-shooting.
 3. Calibration.

4. Testing.
 5. Replacement of components.
 6. Automatic mode operation.
 7. Manual mode operation.
 8. Electronic copy of all shop drawings in AutoCAD version 2024 or newer, and PDF on flash card or jump drive.
 - a. System schematics / shop drawings.
 - b. As-built wiring diagrams of cabinet and enclosure contained assemblies.
 9. Catalog data and complete parts list for all equipment and control devices.
 10. Listing of recommended spare parts.
 11. Listing of recommended maintenance tools and equipment.
- B. One (1) copy of the entire O&M manual shall be provided in electronic PDF format on flash card or USB jump drive.

3.10 RECORD DRAWINGS

- A. The System Integrator shall be responsible to provide a clean and neatly marked up set of record drawings showing any changes from the submittal and Drawings. The Contractor shall provide a hard copy of the final as-built drawings and wiring diagrams in the PLC cabinet for each pump station. These drawings shall be provided prior to final approval of the project and release of the retainage.

END SECTION 40 61 13

SECTION 40 61 98 PROGRAMMING HVAC CONTROLS

PART 1 – GENERAL

1.1 PROGRAMMING

- A. The System Integrator shall provide all programming.
- B. The System Integrator shall provide all programming of the PLC, plant, and operator interface for a complete user-friendly interface and control of the HVAC system.
- C. The System Integrator shall provide communications configuration, PLC programming and testing for interface for data, monitoring and alarming of all HVAC equipment, functions, instruments, etc.
 - 1. The Owner will provide a PLC Program for the Contractor to use. The System Integrator may be directed to modify the programming for the Control Panel.
 - 2. The System Integrator shall provide all other programming, configuration, and modifications unless noted otherwise.
- D. Programming of the pump stations shall be done in such a manner that future troubleshooting and system modifications can be accomplished efficiently.
- E. All PLC registers must include descriptions to the highest extent possible.

1.2 SUBROUTINES

- A. Process controls shall be organized in sub routines to the highest extent possible. Multiple process controls within one subroutine is not acceptable.
- B. If a sub process contains multiple pieces of equipment, it is acceptable for the common equipment controls to be within the same subroutine or function. Start/Stop, Lead/Lag and alternating shall reside within the same ladder file for the associated process only.

1.3 DATA FILES

- A. The data files shall be organized in such a matter that troubleshooting and modifications can be accomplished with ease and efficiency.
- B. Naming for data files shall be as detailed as possible. The description entry shall be filled as detailed as possible for a clear understanding of what the data file contains.
- C. A separate data file shall be created for data that can be organized within the same topic.
- D. Floating point registers (real numbers) shall be used whenever applicable. The use of integers shall not be used in word format unless absolutely necessary.
- E. The use of integer files to the bit level is acceptable for the use of masking and comparing.

- F. Use long integers for accumulations values, such as flow totalization or start counts. It is acceptable to convert the number to a floating point register for display and transmission if convenient.

1.4 CONTROL DESCRIPTIONS

- A. Hot Water Circulation Pump P-7209:
 - 1. The Hot Water Circulation Pump operates by a Call from the Control Panel Remote I/O under any of the following conditions:
 - a. The Outside Air Sensor drops below a temperature setpoint (e.g., 55 degree Fahrenheit).
 - b. AHU-7202-TC-1 detects a low water temperature.
 - c. AHU-7211-TC-1 detects a low water temperature.
- B. The AHU-7202 operates when the Centrifuge or Odor Control Fan B-7191 operates.
 - 1. The Inlet Damper operates with the AHU-7202 fan.
 - 2. The Face – Bypass Damper goes to 100% “Face” to supply the maximum amount of heat to the air flow.
 - 3. Duct smoke detector will shut down the fan on detection of smoke.
 - 4. Liquid immersion manual-reset anti-freeze stat is provided in the discharge water pipe. The AHU-7202 shutdowns on a low temperature detection below 50 degree Fahrenheit.
 - 5. A dirty filter alarm is declared when the differential pressure transmitter detects a high differential pressure (e.g., 1 inch water column).
- C. The AHU-7211 operates continuously.
 - 1. The Inlet Damper operates with the AHU-7211 fan.
 - 2. The Face – Bypass Damper goes to 100% “Face” to supply the maximum amount of heat to the air flow.
 - 3. Duct smoke detector will shut down the fan on detection of smoke.
- D. The F-7205 “Sludge Proc Bldg Lab Area Exhaust Fan” operates when AHU-7211 operates.
- E. The F-7207 “Sludge Proc Bldg Chem Rm Supply Fan” operates continuously except on detection of smoke in the respective duct.
- F. The F-7208 “Sludge Proc Bldg Chem Rm Exhaust Fan” operates when the following:
 - 1. F-7207 operates.
 - 2. And there is no smoke detected in AHU-7211.
 - 3. And there is no smoke detected in F-7207.

- G. The F-7214 “Sludge Proc Bldg Toilet Exhaust Fan” operates through local controls as needed.
- H. Pilot Devices: HAND-OFF AUTO switches located adjacent to the motors provide selected control of the motors individually as follows:
 - 1. Hand position bypasses the level sensing equipment and floats to operate the pump.
 - a. Hand position will not operate the motor while an overload, fault, or pump motor over-temperature condition has been detected.
 - b. The speed potentiometer sets the VFD speed setpoint in HAND mode.
 - 2. Off position does not allow the pump to operate in any mode.
 - a. This switch “off” position is not to be used as a disconnect. For pump/motor maintenance; use the pump disconnect circuit breaker mounted in the motor control center and motor controller enclosure.
 - 3. Auto position allows the pumps to be controlled from the PLC level control programming or the hardwired backup.
 - a. The PLC allows normal automatic operation and on/off based on other equipment operation.
- I. Pilot Devices: ALARM/RESET lighted pushbutton located on the control panel door provide the alarm notification:
 - 1. The Alarm light illuminates if any alarm condition is present.
 - 2. Pressing the lighted pushbutton acknowledges all alarms, clears alarms, and attempts to clear faults on connected devices.
 - a. Send fault reset signal to VFD.
 - b. Send alarm reset to engine generator (through bus communications).
 - 3. Provide flashing sequence to indicate un-acknowledged alarms.

1.5 DAMPER CONTROL

- A. Calculate the Face-Bypass damper actuator position based on measured temperature in the respective AHU supply duct relative to the temperature setpoint.
 - 1. Adjust damper to full bypass when any of the following conditions occur:
 - a. The temperature is outside ambient temperature exceeds the temperature setpoint.
 - b. The respective AHU stops operating.
 - 2. Adjust the damper periodically. For example, compare the temperature setpoint every 10 seconds.

- B. Calculate the supply air supply temperature set point based on the room temperature measurements compared to the temperature setpoint.

1.6 SYSTEM STATUS INDICATION

- A. Running: This status output is present for each pump while it is running. Individual green status lights are annunciated on the front of the control panel. Individual pump-run status signals are transmitted to headquarters via telemetry from motor starter auxiliary contacts.
- B. Ready: Operating and control power present, no failures, and switch in AUTO.

1.7 ALARM HANDLING

- A. Develop alarm programming such that alarm conditions are managed in a common fashion.
- B. Alarm programming shall be developed such that alarm conditions will be managed in a common fashion. Provide the following for each alarm unless noted otherwise:
 - 1. Provide adjustable “de-bounce” timers for all alarm conditions will have.
 - a. When the alarm condition becomes true, the associated alarm timer will latch the alarm after the timer has expired.
 - b. The alarm indication must continue until both the underlying alarm condition clears and the acknowledge button is pressed on the PanelView or the Common Alarm reset pushbutton is pressed on the control panel.
 - 2. Acknowledging an alarm does not clear or reset the alarm conditions, but simply turns off the associated horn and changes conditions on the Operator Interface.
 - a. If the alarm condition is still true when the reset button is pressed, then the alarm remains active.
 - b. When the alarm condition has physically cleared and the ALARM/RESET button is pushed, then the alarm status is cleared.
- C. Fault:
 - 1. This alarm is activated individually for each motor upon tripping of the motor’s overload or other condition. This alarm output will automatically shut down the motor.
 - 2. Overload relays and similar controller functions are set for automatic reset so that a power fault that clears will not disable the pump.
 - 3. The pump will remain in the shutdown condition until the overload resets automatically after a time period that is built into the operating parameters of the overload, the automatic reset sequence described above, or the operations personnel reset the pump by pushing the reset push button.

- D. Motor High Winding Temperature:
 - 1. This alarm is activated individually for each pump when a thermal contact within the winding of the motor senses high temperature and opens.
 - 2. The contact is circuited to the PLC and will automatically shut down the motor and annunciate the alarm locally on the front of the motor control panel.
 - 3. The alarm can be transmitted to headquarters as “motor fail”. Upon cooling of the motor windings, the thermal contact will close and automatically allow the motor to restart. The alarm light located on the front of the control panel will remain on until Operations personnel de-energize it by pressing the Alarm Reset push-button on the front of the panel.

- E. PanelView Alarms:
 - 1. Motor - motor winding high temperature (red).
 - 2. Individual annunciation for high level from transmitter and all high level floats.
 - 3. Low level transmitter and float alarms.
 - 4. Intrusion.
 - 5. Generator alarms.
 - 6. Engine Wastewater Pump alarms.

1.8 TOTALIZING

- A. Provide Current Day, Previous Day, Current Month, Previous Month and Accumulative Runtimes and Start Counters for all equipment with run feedback. Runtimes shall go to tenths of an hour.
- B. Provide Current Day, Previous Day, Current Month, Previous Month and Accumulative flow totalizing.
- C. Display information on the flow data operator interface screen.

1.9 OPERATOR INTERFACE

- A. Update existing operator interface displays to display monitored data:
 - 1. Provide a setpoint adjustment screen for the modification of the standard operational setpoints such as level and ramp control.
 - 2. Provide a screen for the setpoint adjustment of the non-standard operational setpoints (these are the setpoints that the operator would not normally change).

- B. All equipment run status and instrumentation values shall be displayed on operator interface screens in an organized manner as required to maintain an easily navigated operator interface.

- C. All control set points shall be accessible via operator interface and must be secured as requested by owner.
- D. All Alarm setpoints shall have adjustable delays and can be disabled by entering a value of 0 for the delay.
- E. Operator interface will also include Runtime, Start Counter and Flow Total data.
- F. Also included will be alarm summary and alarm history screens.
- G. Provide analog I/O scaling screens.

1.10 STARTUP AND TESTING

- A. Testing shall include I/O testing and program testing for all functions and features (monitoring, alarming, and control) of the program.
- B. All motor operations, alarming & local monitoring shall be tested from the instrument to operator interface.
- C. All alarms shall be tested from point of activation to telemetry.

1.11 TRAINING AND O&M MANUAL

- A. Provide 8 hours of operator training of which will consist of motor operations, safety and security and alarm management.
- B. Provide an O&M manual that can be used as a quick reference guide for operator interface navigation & station operations.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END SECTION 40 61 98

SECTION 40 67 13 CONTROL PANELS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. This section specifies general requirements for the process instrumentation.
- B. Provide the implementation of the process control scheme.
- C. All other aspects of providing instruments within Division 40 shall be performed by the Contractor unless noted otherwise.
- D. Provide equipment as identified on instrument list and described in contract drawings.

Description	Rating	Material
HVAC Control Panel “PNL 7200”	NEMA 1	Mild Steel

1.2 STANDARDS AND CODES

- A. All - materials and methods shall conform to the latest, applicable requirements of documents listed hereafter. In case of conflict between this section and the listed documents, the requirements of this section shall prevail.
 - 1. NFPA 70 National Electrical Code

1.3 SUBMITTALS

- A. Submit project data submittals in accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions.
- B. In accordance with the requirements of Section 40 61 13, Process Control System General Provisions, submit the control panel drawings and product information.

1.4 QUALITY ASSURANCE

- A. All electrical equipment and materials specified herein shall be listed by and shall bear the label of Underwriters Laboratories (UL), Factory Mutual (FM) or other nationally recognized testing laboratory acceptable to the State of Washington Department of Labor and Industries Electrical Division.
 - 1. Provide panels with UL-508A labelling unless otherwise noted.
 - 2. Provide panels with intrinsically safe apparatus with UL-698 labelling.
- B. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings.

1.5 WARRANTY

- A. In addition to the requirements of Section 40 61 13, the control panels shall be warranted to be free from defects in workmanship, design, and materials for a period of 24 months after substantial completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and transport flow meter in accordance with the manufacturer's instructions.

1.7 COORDINATION

- A. The Contractor shall coordinate with the System Integrator (as defined in Section 40 61 13) to ensure proper control, communication, operation, and monitoring of the process control system by the overall plant SCADA system. Resolve any signal incompatibilities and any control component or wiring issues to provide a completely functional system at no additional cost to the Owner.
- B. Control panels which exceed the dimensions depicted on the plans may require adjusting the layout of the room. If control panel dimensions exceed those shown on the plans, provide a revised room layout with the dimensions of all the equipment within the space. Where critical show dimensions conforming to working space requirements.

PART 2 – PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. The Control Panel manufacturer shall be the system integrator identified in Section 40 61 13.

2.2 GENERAL REQUIREMENTS

- A. Design and Assembly:
 - 1. All equipment and materials utilized in the system shall be the products of reputable, experienced manufacturers with at least 5 years' experience in the manufacture of similar equipment. Provide similar items in the system from the same manufacturer.
 - 2. All equipment shall be of industrial grade and of standard construction, shall be capable of long, reliable, trouble-free service, and shall be specifically intended for control and monitoring of operation of motor-driven pumps and equipment.
 - 3. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing. All equipment, where practical, shall be of solid state, integrated circuit design.
 - 4. The system shall be completely assembled in the shop by the System Integrator. All components and equipment shall be prewired to the maximum extent possible.
- B. Labels:
 - 1. All components, including both internal and face-mounted instruments and devices, shall be clearly identified with phenolic nameplates of white background with black letters.

2. Nameplates on the interior of panels shall be White Polyester with printed thermal transfer lettering and permanent pressure sensitive acrylic; TYTON 822 or approved equal.
 3. Terminal Numbering:
 - a. All field terminals shall have unique terminal numbers. 120 Volts alternating current, for example NEUTRAL and LINE, terminals shall be individually identified. (example NU1, NU2 .etc. for UPS neutrals N1, N2 etc. for normal power neutral terminals.)
 - b. Terminal numbers and wire numbers shall relate to the equipment or component number. For example – all PLC I/O terminal & wire numbers shall be the PLC rack/slot/I/O number.
- C. Wireways:
1. Provide wire ways as necessary in the enclosure to contain all internal wiring and all field wiring that exists on this contract with consideration given to future space and the future wiring. Size wireways such that there is ample room for the numbers of wires that will be wired to the terminals or terminal space in the cabinet plus room for an additional 30% future wire.
 2. Provide corner wireways in the cabinet corners or as shown on the drawings.
 3. Low voltage DC (less than 40 volts to ground) control and signal conductors shall be bundled separately from alternating current circuits. Separate raceways and wire gutters shall be dedicated for AC and DC wiring and labeled as such on the shop drawings. Wiring may cross at right angles if necessary. Special caution shall be used for PLC I/O card wiring and field terminations to accommodate the separation of AC and DC circuits.
 4. Separate intrinsically safe wiring from non-intrinsically safe wiring by at least 2 inches.
 5. Internal wiring shall be in separate wireways from the field wiring.
- D. All wiring and tubing crossing hinges shall be installed in a manner to prevent chafing. Bundles of similar conductors shall be clamped securely to the door and to the panel, and the bundles shall run parallel to the hinge for at least 12 inches. Spiral nylon cable wrap shall be provided in the hinge section of the bundle to fully protect the conductors or tubing against chafing.

2.3 INTERCONNECTING WIRING

- A. Conductors:
1. Provided Class C stranded copper, SIS or MTW type conductors for alternating or direct current power and signaling conductors.
 - a. Provide recommended size for conductors connecting to panel mounted equipment.

- b. Unless noted otherwise, provide minimum of 16 AWG for alternating current, discrete signals within the control panel.
 - c. Unless noted otherwise, provide minimum of 20 AWG for direct current, discrete signals within the control panel.
 - d. Unless noted otherwise, provide minimum 14 AWG for power circuits (i.e., not signaling discrete or analog circuits) within the control panel.
 - e. Unless noted otherwise, it is acceptable to use terminal block breakout assemblies manufactured by the same manufacturer as the PLC provided.
2. Analog signals shall use shielded twisted pair or three-conductor shielded cables with overall gray PVC jacket.
 - a. Unless shown otherwise, separate signals shall not share a common multiconductor cable.
 - b. Unless noted otherwise, provide minimum of 20 AWG conductors within shielded cables for analog signals within the control panel.
 - c. Provide thermocouple extension wire of the same or compatible material as the thermocouple device.
 - d. Unless noted otherwise, it is acceptable to use terminal block breakout assemblies manufactured by the same manufacturer as the PLC provided.
 3. Conductors which route outside of the control enclosure shall meet the requirements of Division 26.

2.4 TERMINALS

- A. Power Connections:
 1. Provide terminals with capacity to terminate the conductors of the incoming power circuit.
- B. Discrete Signals:
 1. Provide DIN rail mounted terminal blocks with screw clamp connections.
 2. Provide Entrelec MA 2,5/5 or equal.
- C. Tap Block:
 1. Terminals for the tap block shall be sized to be able to terminate the conductors shown. Tap block shall be suitable for use with copper conductors.
 2. Provide Allen-Bradley 1492-PD series or equal.
- D. Provide all accessories such as jumper bars, end stops, and end sections needed for a complete and functional system of terminal blocks.

2.5 PROGRAMMABLE CONTROL EQUIPMENT**A. General:**

1. Provide a complete and functional control system.
2. Provide accessories, including higher capacity power supplies or software licensing, as needed to provide the described control.

B. Programmable Logic Controller (PLC):

1. The PLC must be manufactured by Rockwell Automation.
 - a. Provide Remote I/O adapter for CompactLogix 5370.
 - b. Provide modules as indicated.
 - c. Provide power supply, filler slots, licenses and other appurtenances as required to make a functional system.
 - d. Register any software licenses to Kitsap County and listing Kitsap County as the registered Owner in perpetuity.
2. Spare and empty slots in the PLC rack shall be covered with a blank slot filler.
3. Ethernet Communication Module:
 - a. Provide Ethernet communications on the PLC processor for communications.
4. Support Equipment and Software:
 - a. Provide one copy of current version of PLC programming software to the Owner. For software registration information please contact the Owner to ensure the correct name and address information is used.
 - b. Provide one copy of current version of operator Interface development software to the Owner.
5. Additional I/O:
 - a. System Integrator shall provide all I/O necessary for the operations of the equipment and instrumentation for the project and as shown on the wire diagrams.
 - b. The System Integrator shall provide additional I/O for the equipment and instrumentation that is outside of the System Integrators scope of supply, but still needs to interface with the control panel as described in Section 40 61 96, Programming Wastewater Pump Stations. Include the additional I/O when calculating the required spare I/O below.

6. Spare and Future I/O:
 - a. Installed Spare: Provide all necessary analog and digital I/O for the project plus 15% installed spare, (round up to the nearest whole number) in each cabinet. Provide terminals for all installed PLC I/O cards (including spares) to match the number of points in the card. For all spare I/O provide interface wiring to terminals.
 - 1) Provide one (1) spare fused disconnect for every four (4) spare digital input terminals.
 - 2) Spare digital outputs shall all be provided with interposing relays with one form C output wired to two (2) terminals for a normally open contact interface.
 - b. For each spare analog input provide one (1) fused, and two (2) non-fused wired for a loop powered instrument input. Provide one (1) shield ground terminal for every two (2) spare analog inputs.

2.6 COMMUNICATIONS EQUIPMENT

A. Ethernet Communications Switch:

1. All Ethernet switches used for this project shall be made by the same manufacturer.
2. Provide an Ethernet switch with ports as required as shown on the drawings plus one (1) spare port. Ethernet switches shall be din rail mountable. The switch ports must communicate both 10 or 100 base T and full of half duplex using at least two (2) pairs (4 conductors). Hirschmann, N-Tron, EtherTrak, Weidmuller, or equal. Provide mounting and power circuits as required for the equipment.

2.7 PILOT DEVICES, OPERATORS, LIGHTS AND PUSHBUTTONS

A. General:

1. Pilot devices (control units and stations): heavy duty, oil-tight type per NEMA ICS-1.
2. Pilot devices shall be contained within metal housings.
3. Provide 30-millimeter pilot devices unless otherwise indicated.

B. Push Buttons:

1. Push buttons and illuminated push buttons shall be for use on 120-volt control circuits and shall have continuous current rating of 10 amperes both inductive and resistive.
2. Pushbuttons for "emergency" "help" applications shall have maintained contacts and red mushroom head operators.
3. Allen Bradley Bulletin 800T, 800H or approved equal.

- C. Indicating Lights:
1. Indicating lights shall be push-to-test LED type unless otherwise noted.
 - a. Illuminated pushbutton type with the pushbutton wired for the push-to-test function required.
 - b. Provide universal voltage LED lamp suitable for use on 12-130 volts alternating or direct current.
 2. Provide lens colors for indicating function. Unless noted otherwise, provide the following lens color:
 - a. Red color shall be used for "Running",
 - b. Green color shall be used for "Stopped",
 - c. Amber shall be used for "Alarm" or "Fault",
 - d. White shall be used for "OK", and
 - e. Blue shall be used for "Maintenance Mode" or "Alternate Mode".
 3. Provide Rockwell Automation (Allen-Bradley) 800T or 800H series, or equal.

2.8 WIRING PROTECTIVE DEVICES

- A. Fuses:
1. Control power fuses shall be FRN for ratings above ten amperes and FNQ for ten amperes and below. FRN fuses are mounted in phenolic blocks with a fuse puller hanging adjacent to them. FNQ fuses are mounted in a Buss CHM1I modular fuse holder with indicator light. Label all fuse holders with fuse identification number and fuse size and type. Provide three spare fuses of each type and size in each panel. Provide box mounted on panel interior marked "SPARE FUSES" to hold the spares.
 2. Control power fuses connected to non-signaling circuits (for example, solenoids, actuators, relay coils, network switches, PLC power supplies) less than 10 amperes and less than 250 volts shall be 13/32 inch x 1-1/2 inch (10.3 x 38.1 mm) midget or CC type, dual element time delay, supplementary protection fuses. Cooper-Bussmann LP-CC dual element series or Littlefuse CCMR series unless otherwise noted or required by Manufacturer of connected equipment.
 3. Provide finger-safe modular fuse holder with blown fuse indicators, Allen-Bradley 1492-FB, Cooper Bussman CH series, Weidmuller UK 10.3, or equal. Plug-in fuse holders mounted to terminal blocks are not acceptable.
 4. Signal power for reference voltage (for example, PLC Input Signals, VFD control circuits, and similar) shall be fast acting fuses ¼ inch x 1-1/4 inch AGC or 13/32 inch x 1-1/2 inch Midget or CC type fuses. Fuses shall be rated at a minimum of 2 amperes. Fuses shall be manufactured by Cooper Bussmann or Littlefuse.

5. Provide finger-safe terminal block, lever style Allen-Bradley 1492-FB series, Phoenix Contact UK series, Weidmuller WSI series, or equal. Plug-in fuse holders mounted to terminal blocks are not acceptable.
 6. 5mm x 20mm fuses (for example, Cooper Bussmann GAS) are not acceptable for any application.
 7. Provide three (3) spare fuses of each type and size in each panel. Provide box secured to panel door interior for signal power fuses marked "SPARE FUSES".
 8. Provide specialty fuse holder for fuses, Cooper Bussmann 5TPM or similar for control power fuses. Mount to panel door interior. Label above each position the ampere rating of the fuse.
- B. Miniature Circuit Breakers: Provide Rockwell Automation 1492-SP or equal.

2.9 WIREWAYS

- A. Provide molded plastic wireways, slotted for wire connections for all wiring in the panels. Provide wireways in the color white unless otherwise noted. They shall be complete with covers.
- B. Wireways shall be a minimum of one inch wide and three inches deep, shall have removable snap on covers and perforated walls for easy wire entrance, shall be constructed of non-metallic materials with a voltage insulation in excess of the maximum voltage carried therein. Wireways shall be Panduit Type G, Panel Channel, or equal.
- C. DIN Rail incorporated wireways are acceptable. Provide a minimum of 3-inch-deep by 3-inch wide wireway. Wireways shall be Panduit.

2.10 SURGE PROTECTIVE DEVICE

- A. Provide surge protective device within service entrance panel for the incoming line from utility power and for the secondary of the 120-power transformer. Surge arrester shall have a short circuit current rating of 65,000 amperes and a surge capacity of 100,000 amperes per phase. Provide protection for three phases plus neutral for 480/277-volt three phase systems and protection for one phase plus neutral on 120-volt single phase systems. Provide Sola/HEVI-Duty STV 100K series or equal.
- B. Provide surge protective device on incoming power within telemetry control panel. Line power surge protective device shall be DIN rail mountable without a separate kit, shall have a listed surge current capacity of 45,000 amps, provide transient protection in all modes for a 20 ampere, 120 volt alternating current power circuit, and provide a form C relay output to signal surge arrester problem. Provide Sola/HEVI-Duty STFE Elite DIN Rail STFE200-10N or equal.

- C. Provide surge protective device on incoming telephone line. Telephone line surge arrestor shall be rated for use with public switched telephone network (i.e., normal telephone service) signaling and shall provide dual stage protection of over-voltage transients as well as sneak voltages. Provide Sola-Hevi Duty STC-TEL-200T or equal.

2.11 RELAYS

- A. Control relays for switching 120 Volts Alternating Current power circuits or motor starting circuits shall be electro-mechanical machine tool, heavy-duty type per NEMA ICS Standard with 120-volt coils and double-break contacts rated B-300 by NEMA standards: Allen-Bradley 700 N, General Electric CR 120, Square D Company Class 8501, Type G or equal, Eaton. Equip relays with surge suppressers. IEC rated relays are not permitted.
- B. Control relays for logic control circuits shall be permitted to be terminal block style type relays. Coils shall be rated 120 Volts Alternating Current or 24 Volts Direct Current (as required). Contacts shall be double break type rated B300 by NEMA standards. Relays shall have indicator flags. Allen-Bradley, or equal.
- C. Time delay relays shall be electronic type Allen Bradley 700 Series or equal.
- D. Intrinsically safe relays shall be fixed sensitivity type U/L approved for use with a remote pilot device (dry contact) located in Class I, Division 1, Group C and D area. Supply power shall be 120-volt AC 60 Hz. Final contact rating shall be 10 amperes or better at 120 volts AC. ISR units shall be as manufactured by GEMS, Stahl, or equal.

2.12 POWER CONVERTERS

- A. 120 Volts Alternating Current to 24 Volts Direct Current:
 - 1. Power supplies shall provide 120 Volts Alternating Current input with 24 Volts direct current output with a user adjustable voltage trim.
 - 2. Provide 10 amperes at 24 Volts direct current unless noted otherwise.
 - 3. Provide Sola Hevi-Duty SDN-C series, or equal.
- B. 120 Volts Alternating Current to 12 Volts Direct Current Power Supply / Battery Charger:
 - 1. Shall supply 15 amperes at 12 Volts Direct Current nominal (14 Volts Direct Current max).
 - 2. Shall provide floating-charge to connected battery when battery is fully charged.
 - 3. Shall be IOTA Engineering DLS-15 or equal.
- C. 120 Volts Alternating Current to 24 Volts Direct Current Class 2 Power Supply:
 - 1. Power supply shall provide power in accordance with NEC Class 2 power supply requirements with an adjustable voltage output around the nominal voltage of 24 Volts direct current. Power supply shall meet UL 1310.

2. Shall provide 3.8 amperes at 24 Volts direct current unless noted otherwise.
 3. Provide Sola Hevi-Duty SDN-P series or equal.
- D. 24 Volts Direct Current to 24 Volts Direct Current, Class 2 Power Supply:
1. Power supply shall provide power in accordance with NEC Class 2 power supply requirements with an adjustable voltage output around the nominal voltage of 24 Volts direct current. Power supply shall meet UL 1310.
 2. Shall provide 3.8 amperes at 24 Volts direct current unless noted otherwise.
 3. Provide Puls CD series or equal.
- E. Uninterruptible Power Supplies shall accept and provide 110 Volts sine wave output with a minimum capacity of 1000 volt-amperes with battery pack sized to provide backup power at full load for 5 minutes. (Step wave UPS output is not acceptable.) Provide Ethernet interface card (web page or SNMP) with patch cable to local network switch. UPS shall be Allen-Bradley 1609-D or equal.

2.13 ACCESSORIES

- A. Panel Nameplates and Identification:
1. Identify each item on the control panel with rectangular nameplates.
 2. Provide nameplates of rigid phenolic plastic laminate with engraved lettering or engraved metal plate with filled lettering. Use black background with white lettering.
 3. Minimum letter height is ½ inch for instrument description and ¼ inch height for instrument tag number.
 4. Provide each panel with a 2 inch by 10 inch (minimum) main nameplate with 1 inch high lettering with panel identification.
 5. Abbreviations are not permitted unless approved by the Owner or specifically shown on the nameplates, schedules, or drawings.
 6. Install nameplates plumb and parallel to the lines of doors or structure to which they are attached. Attach to the sheet metal structure by a thin coat of adhesive and sheet metal screws. Make adhesive and screw application in a manner to avoid buckling or distorting nameplates due to use of excessive adhesive or over tightening of screws.

2.14 SPARE PARTS

- A. Manufacturer's recommended spare parts for 5 years of operation.
- B. Provide spare parts list and include it as part of the O&M Manual. List shall include manufacturer's parts numbers and manufacturer contact information.
- C. Spare equipment shall be provided in its original packaging and contain copies of installation and operation manuals.

PART 3 – EXECUTION**3.1 GENERAL**

- A. The Contractor shall be responsible for coordinating the installation of each instrument. This shall include installation of the instrumentation, mounting hardware, and ancillary equipment. The instrumentation shall be physically installed in accordance with the installation drawings.
- B. Installation shall include all elements and instruments and all interconnecting wiring between all sensors, instrumentation, junction boxes, and panels. All wiring between panels and instruments shall be labeled at both ends for ease of servicing.
- C. All terminations shall be made with solderless pressure connectors. All wiring shall be in accordance with the requirements of the wiring specifications. Technicians skilled and experienced in the installation of instrumentation and control systems shall make the terminations.
- D. Grounding shall follow NEC and manufacturer requirements. Control signal ground wires shall be electrically connected to ground at a single location so as not to induce ground loops. When powering instrumentation from panels other than their associated control panel, isolation shall be used to interface with the instrument control signal at the control panel. Control signal grounding of instrumentation and equipment shall conform to the manufacturer's standards.
- E. Where identified as hazardous from explosive gas, wiring in hazardous locations shall meet the requirements of the NEC. Installation of instrumentation located in Class I Division 1 locations shall conform to Article 504 of the NEC for Intrinsically Safe Systems. Personnel familiar with the installation of instrumentation in hazardous areas shall perform the installation.
- F. The Contractor shall ensure the system is completed and all electrical and process connections are completed prior to the arrival of the manufacturer's representative.

3.2 GENERAL EXECUTION

- A. Fabrication and Assembly:
 - 1. Control panels shall be factory or shop fabricated units completely assembled, wired, and tested before shipment to the job site.
 - 2. Panel construction, in general, shall meet JIC EMP-1 standards and applicable NEMA and IEEE standards.
 - 3. The panels shall be constructed in accordance with electrical testing laboratory standards and shall be so labeled (the standards of a recognized electrical testing laboratory).
 - 4. Size panels for the enclosed equipment and the available space for mounting of the panel, but not smaller than as shown on the Contract Documents.

5. Panels shall be descaled, cleaned, and primed in preparation for painting. Painting shall consist of one coat of flat white enamel in the interior and two coats of hard finish exterior enamel, gray in color for the exterior. Paint shall be suitable for field touch-up. Spare paint (one quart) shall be provided for touch-up purposes.
- B. Labeling:
1. Label wiring within the panel with wire numbers and run in wiring duct neatly tied and bundled with tie wraps or similar materials.
 2. Identify each wire termination, including all jumpers, with permanently marked, heat shrink type wire markers. Arrange wire labels to permit reading of identification when installed. Apply heat per manufacturer's instructions to create a tight fit of the label to the wire.
 3. Label relays at both the top of the relay and on the relay base or on the sub-panel near the relay base.
 4. Label each I/O terminal to indicate tag number of the conductor and connected device. Locate terminals for termination of multiconductor shielded cables adjacent to each other to minimize lengths of unshielded conductor at the terminations.
- C. Installation:
1. Enclosure Installation:
 - a. Minimize welding to panel fronts and avoid distortion of panel metal.
 - b. Reinforce around areas of the enclosure weakened by openings or mounting of heavy equipment/components.
 - c. Accurately and cleanly cut or nibble cut-outs and finish free of sharp edges or burrs. Make cutouts plumb, level, and on-line vertically or horizontally within 1/32 of an inch where components are in rows or columns.
 - d. Provide minimum 1-5/8 inches spacing between horizontal rows of externally mounted components; 1-1/2 inches minimum between vertical columns of components.
 - e. The distance from the bottom row of components to the floor shall be not less than 36 inches, unless specifically shown as less. In general, all indicating lights, pushbuttons, and similar control devices, shall be mounted in accordance with the sequence of operation from left to right and top to bottom.
 - f. Provide minimum 1/4 inch spacing between components mounted on the panel sub-plate, Provide minimum spacing between the component and the wire duct of 1-1/2 inches above and one inch below. Provide additional space if required to access terminals, adjusting screws, and similar items.

- g. Components mounted in the interior shall be fastened to an interior subpanel using machine screws plus adhesive to insure vibration-free attachment.
 - h. Interior component mounting and wiring shall be grouped as much as possible by function and then by component type. Interiors shall be so arranged that control relays, terminal blocks, fuses, etc., can be replaced or added without disturbing adjacent components.
- D. Provide necessary power supplies for control equipment.
 - 1. Provide Class 2 power supplies where Class 2 power is required by the device or component.
 - 2. Provide intrinsically safe barriers, intrinsically safe relays, or intrinsically safe signal conditioners where circuits are identified as intrinsically safe.
- E. Raceways for Panel Wiring:
 - 1. Size raceways per the requirements of NEC.
 - 2. Provide panel wireways between each row of components, and adjacent to each terminal strip.

3.3 PANEL WIRING

- A. Color coding of insulation shall be black for power, white for 120V neutrals, red for AC controls which derive their source from within the panel, yellow for AC controls which derive their source external to the panel, blue for low voltage DC controls, green for grounding conductors.
- B. Shop or factory wire panels to identified terminal blocks equipped with screw type lugs.
- C. Supports shall be cabled to groups and supported so as to prevent breaking and to present an orderly arrangement and neat appearance. All outgoing wiring shall be terminated on a marked terminal strip capable of connection of at least two 14 AWG wires and all terminal connections shall be numbered throughout the system.
- D. Provide wire bending space per NEMA ICS 6.
- E. Terminate conductors routing to field instruments using terminal blocks.
 - 1. Connect wiring internal to the panel to the "inside" of the terminal strip. Connect field wiring to the "outside" of the terminal strip. Wires to enclosure door mounted components are considered as internal wires. Connect no more than two wires to any one control terminal point.
 - 2. Provide terminal jumpers and additional terminals where more than two wires terminate at the same point.
- F. Arrange wiring inside the panel to separate low voltage control signals of the milliamp-millivolt or other low energy type from circuits with higher than 30 volts to ground.

- G. Physically separate signals entering controllers for amplification as control outputs from all line voltage wiring and shield with continuous foil shielding or enclose them in metal raceway.
- H. Shielded cables used for analog signals shall be terminated with not greater than 1 inch of conductor left outside the shield. This applies to field wires entering the panel for termination, and to panel conductors.
- I. Terminate panel wiring on device or terminal block screw terminals using slip-on spade tongue insulated crimp (compression) terminators, slip-on stud insulated crimp (compression) terminators, or stripped and tinned conductor ends. Stranded conductors shall not be terminated bare to terminals or devices.
- J. Conductor twist of shielded or unshielded twisted shall be maintained over the unjacketed length to as close as possible to the point of termination. Where the overall jacket is cut back to expose the individual conductors, provide a heat shrink sleeve over the jacket, the signal, and the shield (drain) conductors.
- K. Insulate the shield (drain) conductor where not covered by the jacket or the sleeve. Where shield (drain) conductors are not terminated, cut the conductor even with the jacket so that it is covered by the sleeve to prevent inadvertent contact with other devices, terminals, or conductors in the panel.
- L. Connect grounds and shields of circuits which derive power internal to the panel to a panel common ground bus which shall be grounded by the electrical contractor in the field.

3.4 TERMINAL BLOCKS

- A. Provide terminal strips for the termination of panel wiring not directly connected to panel mounted devices.
- B. Signals connecting to contacts or coils of ice-cube, terminal block, or other plug-in style relays may use the relay base in lieu of separate terminals for terminating field connections.
- C. Terminals shall facilitate wire sizes as follows:
 - 1. Power (alternating or direct current) applications: Wire size 10 AWG and smaller.
 - 2. Other: Wire size 14 AWG and smaller.
- D. In general, mount terminal strips on the bottom horizontal edge of the sub-plate.
- E. Mount additional terminal strips, if required, on a thirty-degree angle bracket at the bottom of the sub-plate. Where terminal strips are mounted side-by-side, elevate one set of terminals 1-1/2 inches above the sub-plate to allow wire to pass underneath.
- F. Provide 20 percent excess terminals for future expansion. Provide 20 percent of each type of terminal. For example, provide one grounding terminal for every five grounding terminals required by the design.

- G. Provide a minimum of two inches between terminal strips and wireways or between terminal strips. Additional space is not required for combination wireway mounted DIN rail assemblies.
- H. Provide terminals for individual termination of each signal shield. Locate the terminal adjacent to the terminals for the signal conductors.

3.5 PROGRAMMABLE CONTROL EQUIPMENT

A. General:

1. Provide the configuration, programming, set-up, and commissioning to implement and demonstrate a fully functional control system.
2. Testing:
 - a. Provide personnel to assist the Contractor with testing, including at least the following:
 - 1) Field loop testing.
 - 2) Field test and demonstration.
 - b. Correct, replace, or repair panel wiring, and/or components until testing demonstrates proper operation. Do not ship panels to the site until testing has demonstrated satisfactory operation of the panels.
 - c. Factory Testing:
 - 1) The entire assembled panel shall be meggered and tested to be free from grounds and shorts.
 - d. Field Loop Testing.
 - 1) Circuits and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped.
 - 2) Revise all drawings upon completion of the work to show "as shipped" condition of the panel.

B. Configuration:

1. Control panel manufacturer shall configure the components within the control panel such that they are ready for operation as soon as connected at the job site. Coordinate with equipment suppliers for motor specific parameters, such as minimum speed, ramp times, full load amperes, etc. Maintain a record of the configuration and include in the O&M information. Provide to the Owner an electronic copy of configuration suitable for direct loading into a controller device.

3.6 INSTALLATION

- A. Install free-standing panels on concrete pads where shown on the Plans. Install with channel sills where shown on the Plans. Provide stainless steel shims to level units.

- B. Where the bottom of the control panel, mounting bracket, stanchion, or support contacts cement, provide asphaltic felt or bitumastic barrier to isolate the control panel from the cement. It is also acceptable to paint the portion of the cement which contacts the control panel cement with bitumastic paint.
- C. Install wall or stanchion mounted panels level and plumb.
- D. Anchor panels rigidly in place with approved anchorage devices.
- E. Revise all drawings upon completion showing “as built” conditions including the labeling of field wiring connections.
 - 1. Submit preliminary copy of these drawings for inclusion into the Operations and Maintenance Manual.
 - 2. Update the include “as built” drawings for inclusion in the final O&M manuals including changes made during startup and commissioning.

3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of control panels. Vacuum interior and wipe clean all interior surfaces. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

3.8 MANUFACTURER’S SERVICES

- A. Refer to Section 40 61 13, for facility startup and testing requirements.
- B. At a minimum, provide at least two trips onsite of a manufacturer’s field service representative. The onsite visits shall be schedules as one prior and one during the Owner witnessed field loop testing to configure and ensure proper instrument installation and operation.

3.9 TRAINING

- A. Refer to Section 40 61 13, for operator training requirements.

3.10 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Section 40 61 13, for requirements.
- B. As a minimum, include the following:
 - 1. Installation instructions.
 - 2. Description of unit and component parts.
 - 3. Maintenance procedures.
 - 4. Safety precautions.

END SECTION 40 67 13

SECTION 40 70 13 INSTRUMENTATION**PART 1 – GENERAL**

1.1 DESCRIPTION OF WORK

- A. This section specifies general requirements for the process instrumentation.
- B. Provide the implementation of the process control scheme.
- C. All other aspects of providing instruments within Division 40 shall be performed by the Contractor unless noted otherwise.
- D. Provide equipment as identified on instrument list and described in contract drawings.

Tag ID	Description	Type
AHU-7202-TS-1	AHU-7202 Supply Temperature	Duct Air Temperature
AHU-7202-DPT-1	AHU-7202 Filter Diff. Pressure	Differential Pressure
AHU-7211-TS-1	AHU-7211 Supply Temperature	Duct Air Temperature
AHU-7211-DPT-1	AHU-7211 Filter Diff. Pressure	Differential Pressure
AHU-7202-SD-1	AHU-7202 Smoke Detector	Duct Smoke Detector
AHU-7202-TC-1	AHU-7202 Freeze Protection	Duct Temperature Switch
AHU-7211-SD-1	AHU-7211 Smoke Detector	Duct Smoke Detector
AHU-7211-TC-1	AHU-7211 Freeze Protection	Duct Temperature Switch

1.2 STANDARDS AND CODES

- A. All -- materials and methods shall conform to the latest, applicable requirements of documents listed hereafter. In case of conflict between this section and the listed documents, the requirements of this section shall prevail.
 - 1. NFPA 70 National Electrical Code

1.3 SUBMITTALS

- A. Submit project data submittals in accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions.
- B. In accordance with the requirements of Section 40 61 13 – Process Control System General Provisions, submit the control panel drawings and product information.

1.4 QUALITY ASSURANCE

- A. All electrical equipment and materials specified herein shall be listed by and shall bear the label of Underwriters Laboratories (UL), Factory Mutual (FM) or other nationally recognized testing laboratory acceptable to the State of Washington Department of Labor and Industries Electrical Division.
- B. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings.

1.5 WARRANTY

- A. In addition to the requirements of Section 40 61 13, the control panels shall be warranted to be free from defects in workmanship, design, and materials for a period of 24 months after substantial completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and transport flow meter in accordance with the manufacturer's instructions.

1.7 COORDINATION

- A. Coordinate to ensure proper control, communication, operation, and monitoring of the process control system by the overall plant SCADA system. Resolve any signal incompatibilities and any control component or wiring issues to provide a completely functional system.
- B. Control panels which exceed the dimensions depicted on the plans may require adjusting the layout of the room. If control panel dimensions exceed those shown on the plans, provide a revised room layout with the dimensions of all the equipment within the space. Where critical show dimensions conforming to working space requirements.

PART 2 – PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. The Control Panel manufacturer shall be the system integrator identified in Section 40 61 13.

2.2 GENERAL REQUIREMENTS

- A. Design and Assembly:
 - 1. All equipment and materials utilized in the system shall be the products of reputable, experienced manufacturers with at least 5 years' experience in the manufacture of similar equipment. Provide similar items in the system from the same manufacturer.
 - 2. All equipment shall be of industrial grade and of standard construction, shall be capable of long, reliable, trouble-free service, and shall be specifically intended for control and monitoring of operation of motor-driven pumps and equipment.
 - 3. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing. All equipment, where practical, shall be of solid state, integrated circuit design.
 - 4. The system shall be completely assembled in the shop by the System Integrator. All components and equipment shall be prewired to the maximum extent possible.

- B. Mounting:
 - 1. Provide mounting adapters for instruments if required.
- 2.3 DUCT MOUNTED TEMPERATURE TRANSMITTER
- A. Provide transmitter which transmits a 4 milliamp to 20 milliamp signal directly proportional to the measured temperature at the probe with temperatures 20° to 120° Fahrenheit.
 - B. Existing transmitters are Mamac TE-211Z-B-C-1-1-D-7 or similar.
 - C. Provide direct replacements of the same model or similar from:
 - 1. Mamac.
 - 2. Approved equal.
- 2.4 DUCT MOUNTED (OR PLENUM ENCLOSURE) DIFFERENTIAL PRESSURE TRANSMITTER
- A. Provide transmitter which transmits a 4 milliamp to 20 milliamp signal directly proportional to the differential pressure at the probe from 0 to 5 inches of water.
 - B. Existing transmitters are Mamac PR-274-R3-MA or similar.
 - C. Provide direct replacements of the same model or similar from:
 - 1. Mamac.
 - 2. Approved equal.
- 2.5 DUCT MOUNTED SMOKE DETECTOR
- A. Provide smoke detection unit, duct mounting kit, air sample tube, and relay base.
 - B. Existing units are Air Products RWXN or similar.
 - C. Provide direct replacements of the same model or similar from:
 - 1. Kidde Fenwal ESD-4W.
 - 2. Honeywell InnovairFlex D4120.
 - 3. Dwyer SL-2000 Duct Smoke Detector.
 - 4. Approved equal.
- 2.6 WATER LINE MOUNTED LOW TEMPERATURE THERMOSTAT
- A. Provide single pole, double throw temperature switch with manual reset.
 - 1. Adjust temperature switch to close below a temperature setpoint (e.g., 40° Fahrenheit).
 - B. Existing transmitters are Honeywell T675B1002.
 - C. Provide direct replacements of the same model or similar from:
 - 1. Honeywell.

2. Approved equal.

2.7 SPARE PARTS

- A. Manufacturer's recommended spare parts for 5 years of operation.
- B. Provide spare parts list and include it as part of the O&M Manual. List shall include manufacturer's parts numbers and manufacturer contact information.
- C. Spare equipment shall be provided in its original packaging and contain copies of installation and operation manuals.

PART 3 – EXECUTION

3.1 GENERAL

- A. Coordinate the installation of each instrument.
 1. Provide the installation of the instrumentation, mounting hardware, and ancillary equipment.
 2. Install the instrumentation in accordance with the installation drawings.
- B. Provide all elements of the instruments and all interconnecting wiring between sensors, instrumentation, junction boxes, and panels. Label all wiring between panels and instruments at both ends for ease of servicing.
- C. Provide wiring shall be in accordance with the requirements of the wiring specifications. Technicians skilled and experienced in the installation of instrumentation and control systems shall make the terminations.
- D. Provide grounding per NEC and manufacturer requirements.
 1. Connect control signal ground wires to ground at a single location to avoid ground loops.
 2. Provide isolator devices (loop transmitters or interposing relays) when powering instrumentation from panels other than their associated control panel.
 3. Provide control signal grounding of instrumentation and equipment per the manufacturer's standards.
- E. Where identified as hazardous from explosive gas, wiring in hazardous locations shall meet the requirements of the National Electrical Code (NEC) Article 500.
 1. Installation of instrumentation located in Class I Division 1 locations shall conform to Article 504 of the NEC for Intrinsically Safe Systems.
 2. Provide personnel familiar with the installation of instrumentation in hazardous areas.
- F. The Contractor shall ensure the system is completed and all electrical and process connections are completed prior to the arrival of the manufacturer's representative.

3.2 GENERAL EXECUTION**A. Labeling:**

1. Identify each wire termination, including all jumpers, with permanently marked, heat shrink type wire markers.
2. Arrange wire labels to permit reading of identification when installed.
3. Apply heat per manufacturer's instructions to create a tight fit of the label to the wire.
4. Label each I/O terminal to indicate tag number of the conductor and connected device.
5. Locate terminals for termination of multiconductor shielded cables adjacent to each other to minimize lengths of unshielded conductor at the terminations.

B. Installation:

1. Accurately and cleanly cut or nibble cut-outs and finish free of sharp edges or burrs. Make cutouts plumb, level, and on-line vertically or horizontally within 1/32 of an inch where components are in rows or columns.
2. Install instruments per drawings and manufacturer's instructions. Arrange instruments for full range of measurement.

C. Provide necessary power supplies for control equipment.

1. Provide Class 2 power supplies in control panel where Class 2 power is required by the device or component.
2. Provide intrinsically safe barriers, intrinsically safe relays, or intrinsically safe signal conditioners where circuits are identified as intrinsically safe.

D. Raceways for Wiring

1. Size raceways per drawings. Increase the capacity of the raceway if required by NEC requirements.
2. Provide panel wireways between each row of components, and adjacent to each terminal strip.
3. Provide up to 18 inches of liquid-tight flexible metallic conduit (LFMC). It is acceptable to reduce the 18 inches of LFMC by one trade size to accommodate pre-tapped conduit connections.

3.3 EQUIPMENT CONFIGURATION**A. Field Loop Testing:**

1. Manipulate instruments to test full range of detection.
 - a. Provide smoke in a can or other testing apparatus to cause detect to change to alarm state.

- b. Temperature transmitters may be tested at ambient and a controlled, other temperature such as heat gun.
- c. It is acceptable to adjust the switch.

3.4 INSTALLATION

- A. Revise all drawings upon completion showing “as built” conditions including the labeling of field wiring connections.
 - 1. Submit preliminary copy of these drawings for inclusion into the Operations and Maintenance Manual.
 - 2. Update the include “as built” drawings for inclusion in the final O&M manuals including changes made during startup and commissioning.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of control panels. Vacuum interior and wipe clean all interior surfaces. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

3.6 MANUFACTURER’S SERVICES

- A. Refer to Section 40 61 13, for facility startup and testing requirements.
- B. At a minimum, provide at least two trips onsite of a manufacturer’s field service representative. The onsite visits shall be scheduled as one prior and one during the Owner witnessed field loop testing to configure and ensure proper instrument installation and operation.

3.7 TRAINING

- A. Refer to Section 40 61 13, for operator training requirements.

3.8 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Section 40 61 13, for requirements.
- B. As a minimum, include the following:
 - 1. Principle of operation.
 - 2. Installation instructions.
 - 3. Maintenance procedures.
 - 4. Safety precautions.

END SECTION 40 70 13



5 Microns Inc. - Survey Report
7100 Fort Dent Way, Ste. 100
Tukwila, WA 98188 425-440-8787



12351 Brownsville Hwy
Poulsbo, WA 98370

Prepared for: Kevin Stigile / Kitsap County
Date: 08/19/2025

Project Number: Kitsap-Aug1425
Inspector: Carole Seng

NO. NES-BII-20241204-22. Exp. Dec 4, 2025
E-mail: carole.seng@5microns.tech



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1. Background Information and Scope of Work

On 08/14/2025, 5 Microns Inc. conducted an asbestos survey of the residential property at **12351 Brownsville Hwy, Poulsbo, WA 98370**. AHERA-certified building inspector Carole Seng [NES-BII-20241204-22] surveyed to determine the presence of Asbestos Containing Materials (ACMs).

The property was occupied at the time of the inspection and appeared to be in good condition. For this survey, the building was considered a homogeneous area.

Potential asbestos-containing materials were located and sampled from the interior of the building. See Appendix B for a detailed floor plan with sample locations.

Materials were located and sampled following AHERA protocol in 40 CFR 763.86, then analyzed in-house at Seattle per 40 CFR 763.86. See section 3 for detailed sampling information.

2. Building Description

Building 100 is an industrial administration building. Inspection was limited to the boiler room and the East Laboratory.

Structural System

The building was metal.

Finishing Materials

The building was made of gypsum board, and the flooring was vinyl, carpet, and wood.

Mechanical System

The building has a gas boiler system, which is being replaced.

Roofing

The building has a metal roof.

3. Material Sampling Information

Asbestos survey work performed by 5 Microns Inc. meets regulatory inspection requirements enforced by federal, state, and local agencies, including Asbestos Hazard Emergency Response Act (AHERA), WAC 296-62-077 (WISHA), and 40 CFR Part 61 (NESHAP) and 29 CFR Part 1926.1101 (OSHA).

Definitions

- Homogeneous Materials with the same appearance, texture, and color applied during the same general construction period.



- Surfacing Material: Material sprayed on, troweled on, or otherwise applied to surfaces, such as acoustical plaster, texture, joint compound, and fireproofing materials on structural members.
- Thermal System Insulation: Material applied to pipes, fittings, boilers, breaching, ducts, and other interior structural components to prevent heat loss or gain.
- Miscellaneous Material: Building materials such as structural components, structural members, or fixtures not included in surfacing and thermal insulation.

Survey Methodology

Before sampling began, inspectors documented the total surveyed area. A sketch of each space was created, and the total square footage was roughly measured. The inspectors then determined the extent of each visible homogeneous material throughout the survey area.

Materials were classified as surfacing, thermal insulation, or miscellaneous material, and friability was assessed according to AHERA specifications.

Materials were sampled according to 40 CFR 763.86. Depending on homogeneity, square footage, and material type, the proper number of samples needed to assess the location and extent of asbestos accurately was determined and collected. At the point of collection, samples were placed in an appropriate container and labeled. Location was noted on the building floor plan, and a description of the material was recorded with the label number.

Sampling tools were then wiped clean to prevent contamination between samples. Any suspect debris was sealed. The samples were then counted, and their label numbers were recorded on a chain of custody form. The inspector then signed and released the form to the laboratory with the samples. Samples were analyzed in-house at EMSL Analytical.

Materials Sampled

Below is a list of all materials sampled. Appendix C contains the laboratory report and analytical results for each sample.

Material	Location	Sample Location	Condition	Friability	Type
Boiler tape	Boiler room	12 lf 32 lf 10 lf 10 lf 48 lf 10 lf	Good	Non-Friable	M
Boiler baffle	Boiler room	3 lf 8 lf 10 lf 10 lf	Good	Non-Friable	M



Gaskets	Boiler room	6" Gasket	Fair	Non-Friable	M
Pipe Fittings	East Laboratory	2" pipe fitting	Good	Friable	TSI
Pipe Fittings	East Laboratory	3" pipe fitting	Good	Friable	TSI
Pipe Fittings	Boiler room	3" pipe fitting	Good	Friable	TSI

Table: Homogeneous Material Expanded

4. Asbestos-Containing Material

A homogenous material is considered ACM (Asbestos Containing Material) if one or more samples of the material are found to have greater than 1% asbestos. Analysis can result in both positive and negative conclusions in materials containing less than 10% asbestos, or materials that have very fine asbestos fibers, have been hand mixed or have asbestos fibers tightly bound in the matrix; therefore, EPA recommends PLM analyze a minimum of three samples for these types of materials. All materials that were sampled during the inspection were analyzed under PLM, EPA Method 600/R-93/116.

Laboratory results indicate that the following materials were found to be ACM. **The table** below lists all homogeneous areas that tested positive for ACM. The table shows the locations and estimated quantities. The quantities in this table are approximations and are provided for reference only. Estimates were made where areas were inaccessible.

Description	Sample #	Location	Quantity	Asbestos Quantity	Condition
Gaskets / Red Gasket	10	Boiler room	1 x 6 lf	65% Chrysotile Asbestos	Fair

Table: Positive ACM Summary

† Quantity is based upon materials that were reasonably accessible during the inspection or estimated to be present. All quantities are approximations (if used for abatement purposes, each contractor should confirm these amounts). The above is not intended for bidding purposes.

5. Conclusions

The asbestos-containing material must be abated before remodeling can continue. A Certified Asbestos Abatement Contractor must carry out abatement.

Different materials require different abatement processes depending on the friability, type of asbestos, and amount of asbestos present. It is essential that a Certified Asbestos Abatement Contractor treats materials.



6. Appendices

Appendix A – Certifications [Certification Details]

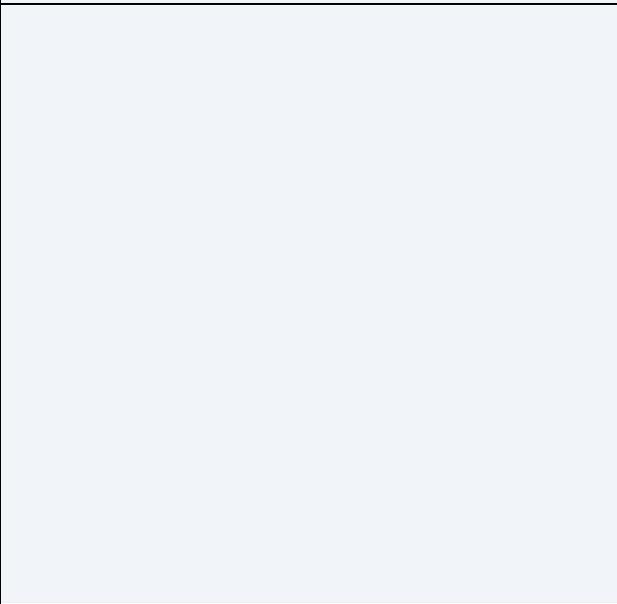




Appendix B – Building Layout
N/A

Appendix C – Photo Log

LOCATION PHOTOS





MATERIAL PHOTOS





SAMPLE PHOTOS



Material: Pipe Fittings
Location: Boiler room



Material: Boiler baffle
Location: Boiler room



Material: Boiler tape
Location: Boiler room



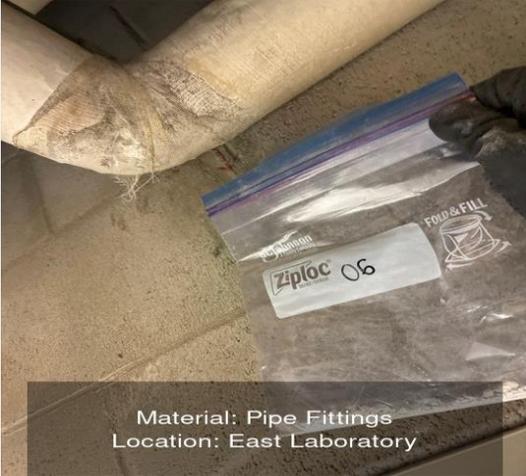
Material: Boiler tape
Location: Boiler room



Material: Pipe Fittings
Location: East Laboratory



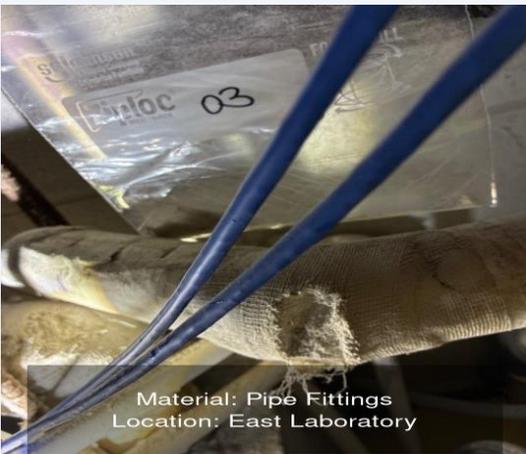
Material: Pipe Fittings
Location: East Laboratory



Material: Pipe Fittings
Location: East Laboratory



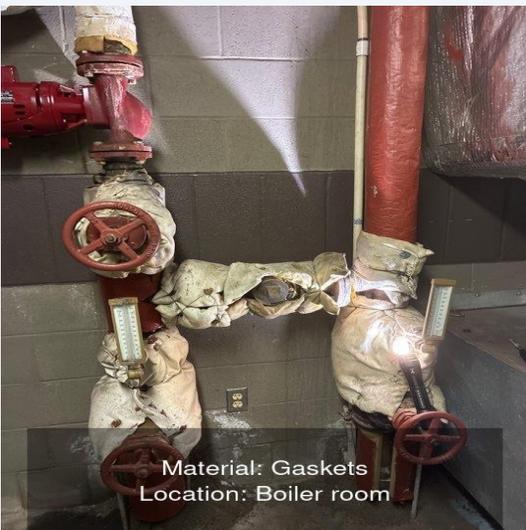
Material: Pipe Fittings
Location: East Laboratory



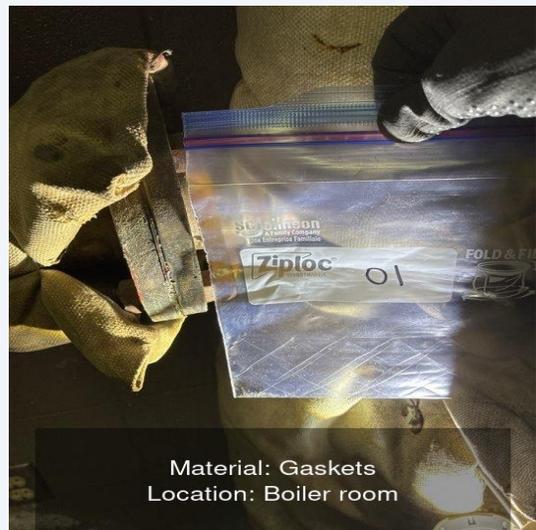
Material: Pipe Fittings
Location: East Laboratory



Material: Pipe Fittings
Location: East Laboratory



Material: Gaskets
Location: Boiler room



Material: Gaskets
Location: Boiler room



Appendix D - Laboratory Report [Laboratory Report and Analytical Results]



EMSL Analytical, Inc.
 5900 4th Avenue S, Suite 100, 1st Floor Seattle, WA 98108
 Phone/Fax: (206) 269-6310/(206) 900-8789
<http://www.emsl.com> / seattlelab@emsl.com

EMSL Order: 512502642
Customer ID: FVMR42
Customer PO:
Project ID:

Attention: Pascal Jean-Baptiste
 5 Microns, Inc.
 7100 Fort Dent Way, Ste. 100
 Tukwila, WA 98188

Phone: (425) 440-8787
Fax:
Received Date: 08/15/2025 10:03 AM
Analysis Date: 08/19/2025
Collected Date: 08/14/2025

Project: Kitsap-Aug1425/Kitsap County - 12351 Brownsville Hwy

**Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E
 Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy**

Sample	Description	Appearance	Non-Asbestos		Asbestos	
			% Fibrous	% Non-Fibrous	% Type	
02-Tape 512502642-0001	Boiler room - Boiler tape	White Fibrous Homogeneous	90% Cellulose	10.0% Non-fibrous (Other)	None Detected	✓
02-Mastic 512502642-0001A	Boiler room - Boiler tape	White/Clear Non-Fibrous Homogeneous		100.0% Non-fibrous (Other)	None Detected	✓
09 512502642-0002	Boiler room - Boiler baffle	Black Fibrous Homogeneous	30% Glass	70.0% Non-fibrous (Other)	None Detected	✓
01 512502642-0003	Boiler room - Gaskets	Black Fibrous Homogeneous		35.0% Non-fibrous (Other)	65% Chrysotile	✗
03-Wrap 512502642-0004	East Laboratory - Pipe Fittings	White Fibrous Homogeneous	95% Cellulose	5.0% Non-fibrous (Other)	None Detected	✓
03-Insulation 512502642-0004A	East Laboratory - Pipe Fittings	White Non-Fibrous Homogeneous	5% Cellulose 5% Glass	90.0% Non-fibrous (Other)	None Detected	✓
04-Wrap 1 512502642-0005	East Laboratory - Pipe Fittings	White/Silver Fibrous Homogeneous	70% Cellulose 20% Glass	10.0% Non-fibrous (Other)	None Detected	✓
04-Wrap 2 512502642-0005A	East Laboratory - Pipe Fittings	White Fibrous Homogeneous	95% Cellulose	5.0% Non-fibrous (Other)	None Detected	✓
04-Insulation 512502642-0005B	East Laboratory - Pipe Fittings	White Non-Fibrous Homogeneous	5% Cellulose 5% Glass	90.0% Non-fibrous (Other)	None Detected	✓
05-Wrap 512502642-0006	East Laboratory - Pipe Fittings	White Fibrous Homogeneous	95% Cellulose	5.0% Non-fibrous (Other)	None Detected	✓

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Seattle, WA NVLAP Lab Code 200613, CA 2733, WA C1025

Initial report from: 08/19/2025 14:26:21



EMSL Analytical, Inc.
 5900 4th Avenue S, Suite 100, 1st Floor Seattle, WA 98108
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Project: Kitsap-Aug1425/Kitsap County - 12351 Brownsville Hwy

**Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E
 Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy**

Sample	Description	Appearance	Non-Asbestos		Asbestos	
			% Fibrous	% Non-Fibrous	% Type	
05-Insulation 512502642-0006A	East Laboratory - Pipe Fittings	White Non-Fibrous Homogeneous	5% Cellulose 5% Glass	90.0% Non-fibrous (Other)	None Detected	<input checked="" type="checkbox"/>
06-Wrap 512502642-0007	East Laboratory - Pipe Fittings	White Fibrous Homogeneous	95% Cellulose	5.0% Non-fibrous (Other)	None Detected	<input checked="" type="checkbox"/>
06-Insulation 512502642-0007A	East Laboratory - Pipe Fittings	White Non-Fibrous Homogeneous	5% Cellulose 5% Glass	90.0% Non-fibrous (Other)	None Detected	<input checked="" type="checkbox"/>
07-Wrap 512502642-0008	East Laboratory - Pipe Fittings	White Fibrous Homogeneous	95% Cellulose	5.0% Non-fibrous (Other)	None Detected	<input checked="" type="checkbox"/>
07-Insulation 512502642-0008A	East Laboratory - Pipe Fittings	White Non-Fibrous Homogeneous	5% Cellulose 5% Glass	90.0% Non-fibrous (Other)	None Detected	<input checked="" type="checkbox"/>
08-Wrap 512502642-0009	East Laboratory - Pipe Fittings	White Fibrous Homogeneous	95% Cellulose	5.0% Non-fibrous (Other)	None Detected	<input checked="" type="checkbox"/>
08-Insulation 512502642-0009A	East Laboratory - Pipe Fittings	White Non-Fibrous Homogeneous	5% Cellulose 5% Glass	90.0% Non-fibrous (Other)	None Detected	<input checked="" type="checkbox"/>
10-Wrap 512502642-0010	Boiler room - Pipe Fittings	White Fibrous Homogeneous	95% Cellulose	5.0% Non-fibrous (Other)	None Detected	<input checked="" type="checkbox"/>
10-Insulation 512502642-0010A	Boiler room - Pipe Fittings	White Fibrous Homogeneous	10% Cellulose 5% Glass	85.0% Non-fibrous (Other)	None Detected	<input checked="" type="checkbox"/>

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Samples analyzed by EMSL Analytical, Inc. Seattle, WA NVLAP Lab Code 200613, CA 2733, WA C1025

Initial report from: 08/19/2025 14:26:21



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Project: Kitsap-Aug1425/Kitsap County - 12351 Brownsville Hwy

**Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E
 Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy**

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type

No Asbestos Detected
 Between Expected Limit of Detection and Federal EPA Recommended Limit
 Above Federal EPA Recommended Limit

These guidance limits are typically used in most scenarios. More stringent local or project specific guidelines may apply.

Analyst(s)
 Carolyn Yeo (6) Sophie Wammer (13)

Ehrin Stephens
 Ehrin Stephens, Laboratory Manager
 or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Seattle, WA NVLAP Lab Code 200613, CA 2733, WA C1025

Initial report from: 08/19/2025 14:26:21



Appendix D - Laboratory Report [Laboratory Report and Analytical Results]

OrderID: 512502642



EMSL ANALYTICAL, INC.
LABORATORY PRODUCTS + TRAINING

5 1 2 5 0 2 6 4 2



12CP-SU3A-NEUF

Client Information
5 Microns Inc.
Account ID FVMR42

Project Overview
Client Kitsap County
PO Number
Project Kitsap County - 12351
Name Brownsville Hwy
Project ID Kitsap-Aug1425
Bill To FVMR42

Project Site
Type Industrial
Address 12351 Brownsville Hwy
City Poulsbo
State WA
Zip 98370

Testing Laboratory
Name Seattle
City Seattle
State WA
Zip 98108

Asbestos Bulk

HA	Sample ID	Material	Location	Date/Time Collected	Test Method	TAT	Notes
001	02	Boiler tape /	Boiler room	8/14/2025 12:41 PM	PLM EPA 600	48 Hour	12 ft 32 ft 10 ft X 10 48 ft 5x2
002	09	Boiler battle	Boiler room	8/14/2025 12:54 PM	PLM EPA 600	48 Hour	3 4x2 5x2 5x2
003	01	Gaskets /	Boiler room	8/14/2025 11:17 AM	PLM EPA 600	48 Hour	6" Gasket
004	03	Pipe Fittings /	East Laboratory	8/14/2025 11:55 AM	PLM EPA 600	48 Hour	2" pipe fitting
004	04	Pipe Fittings /	East Laboratory	8/14/2025 12:10 PM	PLM EPA 600	48 Hour	2"
004	05	Pipe Fittings /	East Laboratory	8/14/2025 11:53 AM	PLM EPA 600	48 Hour	3" pipe fitting
004	06	Pipe Fittings /	East Laboratory	8/14/2025 12:18 PM	PLM EPA 600	48 Hour	3"
004	07	Pipe Fittings /	East Laboratory	8/14/2025 12:28 PM	PLM EPA 600	48 Hour	2"
004	08	Pipe Fittings /	East Laboratory	8/14/2025 12:28 PM	PLM EPA 600	48 Hour	3"
004	10	Pipe Fittings /	Boiler room	8/14/2025 1:01 PM	PLM EPA 600	48 Hour	1 3" in boiler room



 Carol's Seng 8/14/2025 8/14/2025
 Sampled By / Date Relinquished By / Date

 8-15-25 10:03 AM
 Lab Received By / Date
 Z Brooks
 Fr # 8835 8441 7387

JD 8/15/24