KITSAP COUNTY PUBLIC WORKS WASTEWATER DIVISION

SILVERDALE PUMP STATIONS 19 AND 31 UPGRADES

JUNE 2021

CONFORMED SET

Volume 1 of 3

Funded in Part by the Washington State Public Works Trust Fund

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CERTIFICATE PAGE

Kitsap County Public Works Wastewater Division

Silverdale Pump Stations 19 and 31 Upgrades

The engineering material and data contained in the Plans and Specifications were prepared under the supervision and direction of the undersigned, whose seal as a registered professional engineer is affixed below.

4/30/2021

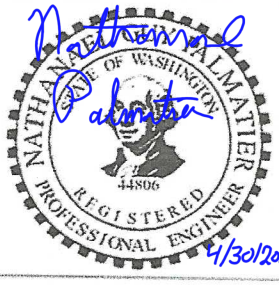
Specifications:
General
Bid Procedures and Conditions
Contract Requirements
WSDOT Division 1 Special Provisions
CSI Division 1 – General Requirements
CSI Division 2 – Existing Conditions
CSI Division 8 – Openings
CSI Division 9 – Finishes
CSI Division 10 – Specialties
CSI Division 22 – Plumbing
CSI Division 31 – Earthwork
CSI Division 32 – Exterior Improvements
CSI Division 33 - Utilities
CSI Division 40 – Process Integration

Tony Fisher, P.E.
BHC Consultants

4/30/21

Specifications:
CSI Division 3 – Concrete
CSI Division 4 – Masonry
CSI Division 5 – Metals
CSI Division 6 – Wood, Plastics, and Composites
CSI Division 7 – Thermal and Moisture Protection
CSI Division 8 – Openings
CSI Division 9 – Finishes
CSI Division 32 – Exterior Improvements

Kenneth E. Dahl, S.E.
BHC Consultants



4/30/2021

Specifications:
CSI Division 26 – Electrical
CSI Division 40 – Process Integration

Nathanael Guy Palmatier, P.E.
BHC Consultants

 4/30/21	Specifications: CSI Division 23 – Heating, Ventilating, and Air Conditioning (HVAC) Kevin Chadwick, P.E., LEED AP BD+C FSi Engineers

KITSAP COUNTY PUBLIC WORKS WASTEWATER DIVISION

SILVERDALE PUMP STATIONS 19 AND 31 UPGRADES

VOLUME 1 OF 3

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APPENDICES – VOLUME 2 OF 3

DRAWINGS (BOUND SEPARATELY) – VOLUME 3 OF 3

INVITATION TO BID
FORMAL BID CONTRACT

KITSAP COUNTY PUBLIC WORKS WASTEWATER DIVISION

SILVERDALE PUMP STATIONS 19 AND 31 UPGRADES

BID SUBMISSION DATE & TIME	**~~May 27~~ June 3, 2021 @ 3:00 p.m.*** **Purchasing Office** **614 Division Street MS-7** **Port Orchard, Washington 98366**
BID OPENING TIME & LOCATION	**~~May 27~~ June 3, 2021 @ 3:15 p.m.*** **Port Madison Conference Room, 4th Floor Room #416** **Kitsap County Administration Building** **619 Division Street** **Port Orchard, Washington 98366**
MANDATORY PRE-BID MEETING	**May 11, 2021 @ 10:00 a.m.** **Kitsap County** **Onsite at Pump Station 19** **Intersection of NW Bucklin Hills Road and Nels Nelson Road NW** **Silverdale, Washington**
ENGINEERS ESTIMATE:	**~~$4,745,000~~ $4,746,500***

The Kitsap County Board of Commissioners will receive sealed bids for the construction of the **Silverdale Pump Stations 19 and 31 Upgrades** until the time and date indicated above. Bids will be received, publicly opened, and read aloud at the location described above. Instructions for the delivery of bids are contained in the Special Provisions for the Project. 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 include:

Pump Station 19 Upgrades

PS 19 is a triplex, submersible type pump station located near the intersection of Nels Nelson Road NW and NW Bucklin Hill Road in Silverdale, Washington. The proposed station will have two submersible pumps and a backup diesel pump and a total station pumping capacity of 1,440 gallons per minute (gpm) with one pump operating and the largest pump out of service. The upgrades will include modifications to the existing wet well and construction of a new control building. The existing dry well and control building will be removed or abandoned in place. The upgrades will also include miscellaneous site work and grading.

Pump Station 31 Upgrades

PS 31 is a duplex, submersible type pump station located in a cul-de-sac off Clover Blossom Lane NE in Bremerton, Washington. The proposed station will have a pumping capacity of 150

gpm with one pump operating and the other pump out of service. The upgrades will include removing the existing pump station, channeling the existing wet well to direct the sewage to the new wet well, installing a new wet well with submersible pumps, and installing new control panels. A new force main will be installed from the pump station to the existing force main located in Clover Blossom Lane NE. The upgrades will also include miscellaneous site work and grading.

A mandatory pre-bid meeting will be held at the location described above and will include a tour of PS 19. After the PS 19 tour, the meeting will shift to the PS 31 site for a tour. This will be the only tour of the sites and facilities.

Bid documents may be found on the Kitsap County Web site www.kitsapgov.com/purchasing/bids.htm. Questions regarding the bid process, contract terms and conditions, or how to obtain copies of the bid documents shall be directed to Vicki Martin at 360-337-4788, or email purchasing@co.kitsap.wa.us. Technical questions about the work covered by the bid documents shall be directed to Floyd Bayless, Construction Manager, at (360) 337-5631 or email fbayless@co.kitsap.wa.us.

Kitsap County reserves the right to reject any 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. **Responders shall submit one (1) signed original. Electronic copies will not be accepted.*** 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;
Subcontractor Responsibility Checklist;
Non Collusion Affidavit
Certification of Compliance with Wage Payment Statutes

Should the successful bidder fail to enter into 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 Engineer's estimate by an unreasonable amount.

Kitsap County hereby notifies all bidders that it will affirmatively ensure that in any contract entered into 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 basis of any other bidder.

**Revised per Addendum #2*

Kitsap County Public Works Wastewater Division
2021-119 IFB
Pump Station 19 – NW Bucklin Hills Rod & Nels Nelson Rd NW, Silverdale, WA
Pump Station 31 – Clover Blossom Land NE, Bremerton, WA
Site Visit Sign-in Sheet
Tuesday, May 18, 2021 @ 9:00AM
PLEASE WRITE LEGIBILITY – PLEASE LEAVE BUSINESS CARD

Name	Company	Phone	Email
JIM LUEBECK	PEASE & SONS	253-531-7700	BIDS@PEASEANDSONS.COM
DION RAASTAD	AWARD CONST.	206-552-1712	award@award-inc.com dion@award-inc.com
MARK SHERBESMAN	MCCLURE & SONS	425-316-6999	BIDS@MCCLUREANDSONS.COM
Will Murphy	Xylem	253-255-1389	will.murphy@xylem.com
David S Berry	Redside Const	206 317 6400	samredside.biz
GARY WOOD	HARBOR PACIFIC CONTRACTORS	425 488 7131	garyw@harborpacific.com
BRENT RICHARDS	Imco	360 815 7518	BRICHARDS@IMCOCONSTRUCTION.COM
Ed Hagedorn	Stellar J	360.225.1996	Bids@StellarJ.com
Ryan Heathers	ACI	253 606 8638	RyanH@activeconstruction.com
Bradley Appleman	Pape & Sons	253 851 6040	brada@Papeinc.com
Jon Vandergrid	Ceccanti		jon@ceccantiinc.com

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BID PROCEDURES AND CONDITIONS

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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 into a contract with the Contracting Agency, 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 has visited the jobsite and is completely familiar with the existing conditions, concurrently scheduled construction, 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 period established in the Contract Document (see Section 1-08.5) 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 his 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

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

DATE	NUMBER
_____	_____
_____	_____
_____	_____
_____	_____

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
2. Bid Guarantee Bond
3. Subcontractor's List
4. Bidder Information
    a. Bidder Responsibility Checklist
    b. Subcontractor Responsibility Checklist
5. Non-collusion Affidavit Certificate
6. Certification of Compliance with Wage Payment Statutes

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 **Silverdale Pump Stations 19 and 31 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.

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. NOTE: UNIT PRICES FOR ALL ITEMS, ALL EXTENSIONS, AND THE TOTAL AMOUNT OF BID MUST BE SHOWN. All prices shall be in legible and written in ink or typed. The proposal shall include: a unit price for each item (omitting digits more than four places to the right of the decimal point); an extension for each unit price (omitting digits more than two places to the right of the decimal point); and the total contract price (the sum of all extensions). Unit prices for all numbers shall be shown in both words and figures. In case of conflict, words shall govern.

The Bidder shall bid on all alternates and/or schedules as they are fully considered in making award. If a bidder fails to bid an alternate or schedule, or if he or she notes “no bid,” it will be construed as meaning that there will be no change in the contract amount and that the alternate or schedule is included in the contract amount. Descriptions for measurement and payment for the following Bid items are included in Section 1-09 of the Special Provisions.

BID SCHEDULE

SCHEDULE A – Pump Station 19

Item No.		Est. Quantity	Unit Price (in words)	Unit Price (in Numbers)	Extended Amount (Qty x Unit Price) (in numbers)
1A	Preconstruction Work Phase	1 LS		$	$
2A	Final Cleanup and Restoration	1 LS		$	$
3A	Surveying	1 LS		$	$
4A	Project Record Drawings[1]	1 LS		$	$
5A	Type B Schedules[2]	12 MO		$	$
6A	Minor Change (Allowance)*	1 FA	Hundred Thirty Thousand Dollars and No Cents	$130,000.00	$130,000.00
7A	Mobilization and Demobilization	1 LS		$	$
8A	Operation and Maintenance Manuals[3]	1 LS		$	$
9A	Dewatering (Allowance)	1 FA	Eighty Thousand Dollars and No Cents	$80,000.00	$80,000.00
10A	Bypass Pumping	1 LS		$	$
11A	Excavation Support Systems	1 LS		$	$

[1] The lump sum for this bid item shall be at least 0.5% of the total bid amount for Schedule A.
[2] The unit price for this bid item shall not be less than $500.00 per month for Schedule A.
[3] The lump sum for this bid item shall be at least 0.5% of the total bid amount for Schedule A.

SCHEDULE A – Pump Station 19

Item No.	Est. Quantity	Unit Price (in words)	Unit Price (in Numbers)	Extended Amount (Qty x Unit Price) (in numbers)
12A Gravel Backfill for Foundations ~~(Allowance)~~**	~~185~~ 200* Tons	_____	$ _____	$ _____
13A Crushed Surfacing Base Course	105 Tons	_____	$ _____	$ _____
14A Crushed Surfacing Top Course	60 Tons	_____	$ _____	$ _____
15A HMA Pavement	10 Tons	_____	$ _____	$ _____
16A Temporary Erosion and Sediment Control	1 LS	_____	$ _____	$ _____
17A PS 19 Submersible Pumps	1 LS	_____	$ _____	$ _____
18A PS 19 Mechanical Work	1 LS	_____	$ _____	$ _____
19A PS 19 Electrical Work	1 LS	_____	$ _____	$ _____
20A PS 19 Wet Well Modifications	1 LS	_____	$ _____	$ _____
21A PS 19 Diesel Pump	1 LS	_____	$ _____	$ _____
22A PS 19 Control Building	1 LS	_____	$ _____	$ _____
23A PS 19 Storm Drainage	1 LS	_____	$ _____	$ _____

SCHEDULE A – Pump Station 19

Item No.	Est. Quantity	Unit Price (in words)	Unit Price (in Numbers)	Extended Amount (Qty x Unit Price) (in numbers)
24A Permeable Concrete Pavement	1 LS	_____	$ _____	$ _____
25A PS 19 Miscellaneous Site Work	1 LS	_____	$ _____	$ _____
26A Existing Utility Relocation (Allowance)*	1 FA	Fifty Thousand Dollars and No Cents	$50,000	$50,000
27A PS 19 Facility Testing and Startup[4]	1 LS	_____	$ _____	$ _____

Subtotal of Schedule A Bid Items	$ _____
Sales Tax @ 9%	$ _____
Total for Schedule A – Pump Station 19	$ _____

[4] The lump sum for this bid item shall be at least 1.0% of the total bid amount for Schedule A.

SCHEDULE B – Pump Station 31

Item No.	Est. Quantity	Unit Price (in words)	Unit Price (in Numbers)	Extended Amount (Qty x Unit Price) (in numbers)
1B Preconstruction Work Phase	1 LS		$	$
2B Final Cleanup and Restoration	1 LS		$	$
3B Surveying	1 LS		$	$
4B Project Record Drawings[5]	1 LS		$	$
5B Type B Schedules[6]	10 MO		$	$
6B Minor Change (Allowance)*	1 FA	Fifty Thousand Dollars and No Cents	$50,000.00	$50,000.00
7B Mobilization and Demobilization	1 LS		$	$
8B Operation and Maintenance Manuals[7]	1 LS		$	$
9B Dewatering (Allowance)	1 FA	Sixty Thousand Dollars and No Cents	$60,000.00	$60,000.00
10B Bypass Pumping	1 LS		$	$
11B Excavation Support Systems	1 LS		$	$

[5] The lump sum for this bid item shall be at least 0.5% of the total bid amount for Schedule B.
[6] The unit price for this bid item shall not be less than $500.00 per month for Schedule B.
[7] The lump sum for this bid item shall be at least 0.5% of the total bid amount for Schedule B.

SCHEDULE B – Pump Station 31

Item No.	Est. Quantity	Unit Price (in words)	Unit Price (in Numbers)	Extended Amount (Qty x Unit Price) (in numbers)
12B Gravel Backfill for Foundations ~~(Allowance)**~~	~~35~~ 60* Tons		$	$
13B Crushed Surfacing Base Course	10 Tons		$	$
14B Crushed Surfacing Top Course	40 Tons		$	$
15B HMA Pavement	10 Tons		$	$
16B Temporary Erosion and Sediment Control	1 LS		$	$
17B PS 31 Submersible Pumps	1 LS		$	$
18B PS 31 Mechanical Work	1 LS		$	$
19B PS 31 Electrical Work	1 LS		$	$
20B PS 31 Wet Well Modifications	1 LS		$	$
21B PS 31 Retaining Walls	1 LS		$	$
22B PS 31 Storm Drainage	1 LS		$	$
23B PS 31 Miscellaneous Site Work	1 LS		$	$

SCHEDULE B – Pump Station 31

Item No.	Est. Quantity	Unit Price (in words)	Unit Price (in Numbers)	Extended Amount (Qty x Unit Price) (in numbers)
24B PS 31 Facility Testing and Startup[8]	1 LS	_____	$ _____	$ _____

Subtotal of Schedule B Bid Items	$ _____
Sales Tax @ 9%	$ _____
Total for Schedule B – Pump Station 31	$ _____

TOTAL FOR SCHEDULES A AND B WITH SALES TAXS	**$** _____

*Allowance - For the purpose of establishing a common basis for evaluating bids, an arbitrary quantity for this item has been shown on the bid form and does not necessarily represent the quantity that may be necessary for the work. The Variation in Estimated Quantities provisions of Section 1-04.6 of the Standard Specifications shall not apply to this item. Quantities will be determined in the field as work progresses.

[8] The lump sum for this bid item shall be at least 1.0% of the total bid amount for Schedule B.

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.

AWARD OF SCHEDULES:

The Proposal contains multiple schedules to assist the County in tracking the costs associated with separate components of the overall project. The intent of the County is to award a Contract for all schedules to the lowest responsive and responsible bidder provided the Bid has been submitted in accordance with the requirements of these specifications. However, the County reserves the right to award any of the schedules singularly or in combination thereof. Failure to complete all schedules in their entirety will result in the bid being non-responsive. The sum of all schedules will be used to determine the lowest responsible bidder.

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 any and 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 GUARANTEE:

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 Guarantee 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: (_____) _____ Fax: (_____)_____

END OF BID PROPOSAL

BID GUARANTY BOND

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: **Silverdale Pump Stations 19 and 31 Upgrades**.

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 _____, 2021.

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 GUARANTEE 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: _____

STRUCTURAL STEEL INSTALLATION

Subcontractor Name: _____

REBAR INSTALLATION

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

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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)

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 any and 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: Silverdale Pump Stations 19 & 31 Upgrades	Project Number:
Bidder's Business Name:	Bid Submittal Deadline:
Contractor Registration	
License Number:	Status: Active: Yes ☐ No ☐
Effective Date (must be effective on or before Bid Submittal Deadline):	Expiration Date:
Contractor Infraction List	
Is Bidder on Infraction List? Yes ☐ No ☐	
Current UBI Number	
UBI Number:	Account Status: Open ☐ Closed ☐
Industrial Insurance Coverage	
Account Number:	Account Current: Yes ☐ No ☐
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 ☐ Closed ☐
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 ☐ No ☐	
Bankruptcy	
Has the Bidder declared Bankruptcy in the last five (5) years? Yes ☐ No ☐	
Information Supplied by:	
Print Name of Bidder Representative:	Date:

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

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: Silverdale Pump Stations 19 & 31 Upgrades	Project Number:
Subcontractor's Business Name:	Subcontract Execution Date:
Contractor Registration	
License Number:	Status: Active: Yes ☐ No ☐
Effective Date (must be effective on or before Subcontract Bid Submittal Deadline):	Expiration Date:
Contractor Infraction List	
Is Subcontractor on Infraction List? Yes☐ No☐	
Current UBI Number	
UBI Number:	Account Status: Open ☐ Closed ☐
Industrial Insurance Coverage	
Account Number:	Account Current: Yes ☐ No ☐
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 ☐ Closed ☐
Not Disqualified from Bidding	
Is the Subcontractor listed on the "Contractors Not Allowed to Bid" list of the Department of Labor and Industries? Yes ☐ No ☐	
Contractor Licenses	
Electrical: If required by Chapter 19.28 RCW, does the Subcontractor have an Electrical Contractor's License? Yes☐ No☐	Elevator: If required by Chapter 70.87 RCW, does the Subcontractor have an Elevator Contractor's License? Yes☐ No☐
Checked by:	
Name of Employee:	Date:

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

PROJECT REFERENCES

Using the following form (use additional forms as needed), the Bidder shall describe projects that meet the similar size and scope criteria of Section 1-02.1.

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: _____

_____

_____

_____

_____

_____

_____

[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

NON-COLLUSION AFFIDAVIT

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

_____ Sole Proprietorship _____
Legal Name of Bidder

Partnership _____

_____ Corporation _____
By (Signature)

Other _____

_____
Street Address

_____
City State Zip

_____
Telephone

_____
State of Washington Contractor's Number

STATE OF WASHINGTON)
( ) SS.
COUNTY OF KITSAP)

On this day personally appeared before me _____ to me known to be the individual described in and who executed the within and foregoing instrument, and acknowledged that _____ signed the same as _____ free and voluntary act and deed, for the uses and purposes therein mentioned.

GIVEN under my hand and official seal this _____day of _____, 2021

_____Notary Public in and for the State of Washington, residing at

_____

My Commission Expires:_____

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

END OF NON-COLLUSION AFFIDAVIT

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CERTIFICATION OF COMPLIANCE WITH WAGE PAYMENT STATUTES

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date of May 27, 2021, the bidder is not a "willful" violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

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

_____
Bidder's Business Name

_____
Signature of Authorized Official*

_____
Printed Name

_____
Title

_____	_____	_____
Date	City	State

Check One:

Sole Proprietorship ☐ Partnership ☐ Joint Venture ☐ Corporation ☐

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

_____

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

_____

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

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

END OF CERTIFICATION OF COMPLIANCE WITH WAGE PAYMENT STATUTES

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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 Project Manual and proper completion and submission of the Bid.

1. Contract Documents thoroughly read and understood. _____
2. Attend pre-bid conference. _____
3. All blank spaces in proposal filled in, preferably in black ink. _____
4. Receipt of all addenda acknowledged. _____
5. Review of geotechnical information acknowledged. _____
6. Bid Form and other documents are signed by authorized officer. _____
7. Prices computed and presented correctly. _____
8. Subcontractors are named as indicated in the Contract Documents. _____
9. The following documents, to be submitted with the bid, completed, signed, and dated as applicable.
    a. Bid Proposal _____
    b. Bid Guaranty Bond _____
    c. Subcontractors List _____
    d. Bidder Information _____
        i. Bidder Responsibility Checklist _____
        ii. Subcontractor Responsibility Checklist _____
    e. Non-Collusion Affidavit Certificate _____
    f. Certification of Compliance with Wage Payment Statutes _____
10. Bid documents submitted in sealed envelope and properly labeled.
11. The following documents shall be executed and complied with after the contract is awarded: _____
    a. Capital Projects Contract Agreement _____
    b. Performance and Payment Bond _____
    c. Insurance Certificates

END OF BIDDER'S CHECKLIST

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CONTRACT REQUIREMENTS

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CAPITAL PROJECTS CONTRACT AGREEMENT

This Contract is made and entered into this _____ day of _____, 2021 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 **Silverdale Pump Stations 19 and 31 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 two wastewater pump stations and associated support infrastructure in accordance with the Contract Documents entitled "Silverdale Pump Stations 19 and 31 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:	Barbara Zaroff
Title:	Project Manager
Mailing Address:	614 Division Street MS #27
City, State, and Zip Code:	Port Orchard, WA 98366
Telephone Number:	360-337-5777
Email Address:	bzaroff@co.kitsap.wa.us

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 1-08.5 of the Special Provisions will subject the Contractor to the payment of liquidated damages as described in Section 1-08.9 of the Standard Specifications and the Special Provisions.

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 1-07.9 of the Standard Specifications and the Special Provisions.

7. PERFORMANCE AND PAYMENT BOND

Contractor agrees to provide a Performance and payment Bond as described in Section 1-03.4 of the Standard Specifications as amended by the Special Provisions.

8. HOLD HARMLESS AND INDEMNIFICATION

The Contractor shall hold harmless, indemnify and defend the Contracting Agency, Engineer, 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 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, Engineer, 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 1-07.18 of the Special provisions.

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 1-08.10 of the Standard Specifications as amended by the Special Provisions.

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 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. MODIFICATION

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

21. COMPLIANCE WITH LAWS

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

22. 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 _____, 2021.

CONTRACTOR:

Firm _____

By _____

Signature: _____
(Authorized Representative)

Title

_____

Address: _____

_____

Contractor Registration No. _____

Federal Tax ID No. _____

BOARD OF COUNTY COMMISSIONERS
Kitsap County, Washington

_____
Charlotte Garrido, Commissioner

_____
Robert Gelder, Commissioner

_____
Edward E. Wolfe, Commissioner

Attest:

_____
Dana Daniels, Clerk of the Board

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

END OF CAPITAL PROJECTS CONTRACT AGREEMENT

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PUBLIC WORKS PAYMENT BOND
TO KITSAP COUNTY, WA

Bond No. _____

Kitsap County, Washington, (County) has awarded to _____ (Principal), a contract for the construction of the project designated as **Silverdale Pump Stations 19 and 31 Upgrades**, in Kitsap County, Washington (Contract), and said Principal is required under the terms of that Contract to furnish a payment bond in accord with Title 39.08 Revised Code of Washington (RCW) and (where applicable) 60.28 RCW.

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 payment bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall pay all persons in accordance with RCW Titles 39.08 and 39.12 including all workers, laborers, mechanics, subcontractors, and material suppliers, and all persons who shall supply such contractor or subcontractor with provisions and supplies for the carrying on of such work; and if such payment 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, except as provided herein, 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.

PRINCIPAL		SURETY	
_____		_____	
Principal Signature	Date	Surety Signature	Date
_____		_____	
Printed Name		Printed Name	
_____		_____	
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 **Silverdale Pump Stations 19 & 13 Upgrades**, 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.

PRINCIPAL		SURETY	
_____		_____	
Principal Signature	Date	Surety Signature	Date
_____		_____	
Printed Name		Printed Name	
_____		_____	
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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SPECIAL PROVISIONS

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INTRODUCTION TO THE SPECIAL PROVISIONS

The work on this project shall be accomplished in accordance with the Standard Specifications for Road, Bridge and Municipal Construction, 2020 edition, as issued by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), Washington State Chapter (hereafter "Standard Specifications"). The Standard Specifications, as modified or supplemented by the Amendments to the Standard Specifications and these Special Provisions, all of which are made a part of the Contract Documents, shall govern all of the Work.

These WSDOT Special Provisions are made up of both General Special Provisions (GSPs) from various sources, which may have project-specific fill-ins; and project-specific Special Provisions. Each Provision supplements, modifies, or replaces the comparable Standard Specification, or is a new Provision. The deletion, amendment, alteration, or addition to any subsection or portion of the Standard Specifications is meant to pertain only to that particular portion of the section, and in no way should it be interpreted that the balance of the section does not apply.

The GSPs are labeled under the headers of each GSP, with the date of the GSP and its source, as follows:

(May 18, 2007 APWA GSP)

(August 7, 2006 WSDOT GSP)

Project specific Special Provisions are labeled under the heading of each Special Provision as follows:

(Local Agency SP)

The specifications also include Construction Specification Institute (CSI) formatted specifications Divisions 1 to 41 (6-digit format). The CSI specifications are generally used for pump station specific items such as structures, mechanical equipment, electrical items, etc. The CSI specifications are supplemental to the WSDOT Special Provisions and WSDOT standards.

Also incorporated into the Contract Documents by reference are:

1. *Manual on Uniform Traffic Control Devices for Streets and Highways*, currently adopted edition, with Washington State modifications, if any
2. *Standard Plans for Road, Bridge and Municipal Construction, WSDOT/APWA, current edition*

Contractor shall obtain copies of these publications, at Contractor's own expense.

END OF INTRODUCTION

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1-01 Definitions and Terms

1-01.3 Definitions

Section 1-01.3 is supplemented as follows:
(Local Agency SP)

All references in the Standard Specifications, Amendments, or WSDOT General Special Provisions, to the terms “State”, “Department of Transportation”, “Washington State Transportation Commission”, “Commission”, “Secretary of Transportation”, “Secretary”, “Headquarters”, and “State Treasurer” shall be revised to read “Contracting Agency”.

All references to “State Materials Laboratory” shall be revised to read “Contracting Agency designated location”.

All references to “final contract voucher certification” shall be interpreted to mean the final payment form established by the Contracting Agency.

The venue of all causes of action arising from the advertisement, award, execution, and performance of the contract shall be in the Superior Court of the County where the Contracting Agency’s headquarters are located.

Acceptance – Formal action of the Owner in determining that the Contractor's work has been completed in accordance with the contract and in notifying the Contractor in writing of the acceptability of the work.

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.

Additive – A supplemental unit of work or group of bid items, identified separately in the Bid Proposal, which may, at the discretion of the Contracting Agency, be awarded in addition to the base bid.

Alternate – One of two or more units of work or groups of bid items, identified separately in the Bid Proposal, from which the Contracting Agency may make a choice between different methods or material of construction for performing the same work.

Application for Payment – The form accepted by the Engineer which is to be used by the Contractor in requesting progress and final payments and which is to include such supporting documentation as is required by the Contract Documents.

Bid Proposal Form – Bid Proposal Form shall mean the same as the definition provided for the term “Proposal Form.”

Business Day – A business day is any day from Monday through Friday except holidays as listed in Section 1-08.5.

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

Contract Bond – The definition in the Standard Specifications for “Contract Bond” applies to whatever bond form(s) are required by the Contract Documents, which may be a combination of a Payment Bond and a Performance Bond.

Contract Documents – See definition for “Contract”.

Contract Drawings – Contract Drawings or Drawings shall mean the same as the definition provided for the term “Contract Plans” or “Plans.”

Contracting Agency – The Contracting Agency shall mean Kitsap County, a municipal corporation, acting and existing under the laws of the State of Washington.

Contract Price – The amount payable to the Contractor under the terms and conditions of the contract provisions based on the lump sum prices, unit prices, or combination thereof, on the Bidding Schedule, with adjustments made in accordance with the Contract.

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

Dates – Delete the heading Completion Dates and the three paragraphs that follow it, and replace them with the following:

Bid Opening Date – The date on which the Contracting Agency publicly opens and reads the 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 Date – The date the Contracting Agency officially binds the agency to the Contract.

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

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

Substantial Completion Date – The day the Engineer 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, replacement of temporary substitute facilities, plant establishment periods, or correction or repair remains for the physical completion of the total contract.

Physical Completion Date – The day all of 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 Date – The day all the work specified in the contract is completed and all the obligations of the Contractor under the contract 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 Date – The date on which the Contracting Agency accepts the work as complete.

EADOC – The web-based electronic media site that is hosted by EADOC LLC. Information may be obtained at www.EADOCsoftware.com. EADOC is a project management system for facilitating document workflows, communication, and collaboration, which assists in the management of construction projects. It serves as a single source for project information for communication and collaboration among all project participants by automating various tasks in an organization of modules. EADOC provides secure, permissions-based access requiring the identification of all users and their approved access rights.

Electronic Documents – The electronic form or image of Project Communications that can be stored on and retrieved from an electronic storage device through a collaboration system over the Internet. Includes all written and graphic products produced with computer software or converted to electronic form or electronic image by computer software.

Engineer – Engineer shall mean either the Contracting Agency's design engineer or the Contracting Agency's construction administration representative.

Field Directive – A written order issued by Engineer which requires minor changes in the Work, but which does not involve a change in the Contract Price or the Contract Times.

Invitation to Bid – The definition is the same as that provided for the term "Call for Bids."

Limited Notice to Proceed – Written notice from the Contracting Agency informing the successful Bidder to start the Work associated with the Preconstruction Work Phase. See Section 1-04.3 for additional information.

Notice – As defined in the Contract. Notice for documents transmitted through EADOC is the time and date when the document is sent to the other party as recorded in EADOC.

Notice of Award – The written notice from the Contracting Agency to the successful Bidder signifying the Contracting Agency's acceptance of the Bid Proposal.

Notice to Proceed with Construction – The written notice from the Contracting Agency or Engineer to the successful Bidder authorizing and directing the Contractor to proceed with the Construction Work Phase. The Notice to Proceed with Construction establishes the date on which the contract time begins. See Sections 1-04.3 and 1-08.4 for additional information.

Owner – The definition is the same as that provided for the term "Contracting Agency".

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 Contracting Agency provided form within ten (10) calendar days of receipt of Notice of Award.

Project Communications – All written documentation and written communications required by the Contract Documents including, but not limited to: correspondence, reports, notices, submittals, transmittals, RFI's, request for change orders, payment applications, change orders, claims, change proposals, field orders, meeting agendas and minutes, substitutions, test reports, monitoring reports, punchlists, and all other formal Contract communications. Project communications shall also include documents required by the Contract that include written documents, demands, instruments, or directives, unless otherwise indicated in this Section.

Project Data – Samples, certifications, material specifications, installation procedures, catalog data or other materials, equipment, or other information intended to describe items to be furnished by the Contractor for the project and which are identified as required submittals in the Standard Specifications and Special Provisions.

Project Team – The associated members of the Owner, Owner Consultants, Construction Manager, Design Engineer, Contractor, Subcontractors, and Vendors.

Quality Assurance – A program establishing policies, procedures, standards, training, guidelines, testing, and systems necessary to provide quality in the work to meet the project requirements and accepted industry standards.

Quality Control – Those activities that provide confidence that materials and workmanship will meet the requirements of the contract to fulfill the project objectives. The Contractor is responsible for the quality control of the project.

Shop Drawings – Drawings prepared by the Contractor or his/her suppliers or subcontractors to describe detailed dimensions and materials of items to be furnished for the work. Shop drawings are not contract Drawings.

Total Bid Price – The sum of all bid prices offered by the bidder as set forth in the Bidding Schedule on the Bid Proposal form.

Traffic - Both vehicular and non-vehicular traffic, such as pedestrians, bicyclists, wheelchairs, and equestrian traffic.

Work Directive – A written directive to the Contractor, recommended by the Engineer, issued on or after the effective date of the Notice to Proceed and signed by the Contracting Agency's Representative, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed, or to emergencies. A Work Directive may or may not change Contract Price or Contract Time, but is evidence that the parties expect that the change directed or documented by the Work Directive will be incorporated in a subsequently issued Change Order following negotiations of the parties as to its effect, if any, on the Contract Price or Contract Time.

END OF SECTION 1-01

1-02 Bid Procedures and Conditions

1-02.1 Prequalification of Bidders

Section 1-02.1 is deleted and replaced with the following:
(Local Agency SP)

1-02.1 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. A 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(1) Subcontractor Responsibility

The Contractor shall include the language of this section in each of its first tier subcontracts, and shall require each of its subcontracts to include the same language of this section in each of their subcontracts, adjusting only as necessary the terms used for the contracting parties. Upon request of the Contracting Agency, the Contractor shall promptly provide documentation to the Contracting Agency demonstrating that the subcontractor meets the subcontractor responsibility criteria below. The requirements of this section apply to all subcontractors regardless of tier. The subcontractor shall:

1. Have a current certificate of registration as a contractor in compliance with Chapter 18.27 RCW at the time of subcontract bid submittal;
2. Have a current Washington Unified Business identifier (UBI) number;
3. If applicable, have:
    a. Industrial insurance coverage for the subcontractor’s employees working in Washington as required in Title 51 RCW;
    b. A 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; and/or
    d. An electrical contractor license, if required by Chapter 19.28 RCW.
4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3).

1-02.1(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 Contractor performing wastewater construction r 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 project 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 pump station installations and/or upgrades with a minimum capacity of 500 gpm. All of the following shall be included on each project: constructing new buildings or modifying existing buildings, constructing a new wet well, installing new or replacing existing piping and valves, installing new or replacing existing MCC panels, and installing new generators. Separate projects may be used to demonstrate compliance with these installation requirements. Each project shall also have a construction cost in excess of $750,000.

1-02.1(3) Documentation

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

1. Bidder Responsibility Checklist.
2. Subcontractor Responsibility Checklist, provide for each subcontractor identified in Bidder's Subcontractors List.

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. Bidder shall not be listed on the Washington State Department of Revenue's "Delinquent Taxpayer List" website: http://dor.wa.gov/content/fileandpaytaxes/latefiling/dtlwest.aspx.

3. 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 similar to 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.

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.

1-02.1(4) 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.

1-02.1(5) Other Conditions

Specialty contractor experience and qualification requirements are specified in other sections of the Special Provisions. While the Contractor will be required to conform to those additional qualifications, they are not criteria that will be evaluated as a condition for determining if the bidder is responsible.

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 each individual 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.

1-02.2 Plans and Specifications

Section 1-02.2 is deleted and replaced with the following:
(Local Agency SP)

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")	5	Furnished automatically with the limited NTP
Standard plans (22" x 34")	2	Furnished automatically with the limited NTP
Contract Provisions	5	Furnished automatically with the limited NTP

Additional copies of the Contract Plans and Contract Provisions may be purchased by the Contractor by payment of the cost of reproduction.

1-02.4(2) Subsurface Information

The first paragraph of Section 1-02.4(2) is deleted and replaced with the following:
(Local Agency SP)

The Contracting Agency has made limited subsurface investigations and the boring log data and soil sample test data accumulated by the Contracting Agency is available in an appendix in the Bid Documents. This data is informational only and shall not be considered as part of the Contract. The Contracting Agency makes no representation or warranty expressed or implied that:

1. The Bidder's interpretations from the boring logs are correct.
2. Moisture conditions and indicated water tables will not vary from those found at the time the borings were made.
3. The ground at the location of the borings has not been physically disturbed or altered after the boring was made.

The Contractor may not rely upon or make any claim against the Contracting Agency or Engineer with respect to:

1. The completeness of such data and reports for Contractor’s purposes, including, but not limited to any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
2. Other data, interpretations, opinions, and information contained in such reports; or

3. Any Contractor interpretation of, or conclusion, drawn from such technical data or any such other data, interpretations, opinions, or information.

The Contractor is advised that additional geotechnical investigations and engineering could be required and should be considered and taken into account as part of the requirements of the work. Such investigations and engineering could be required to augment or support the available technical data, particularly to assess or verify the in-situ conditions in areas which were not investigated in order to meet the Contractor's needs and requirements for construction, especially for shoring, dewatering, or other special construction that is dependent on, and affected by, site specific in-situ conditions. Contractor shall evaluate his needs for this additional information and all costs for gathering said information shall be incidental to other bid items.

1-02.5 Proposal Forms

Section 1-02.5 is deleted and replaced with the following:
(June 27, 2011 APWA GSP)

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, unit prices; extensions; summations; the total bid amount; signatures; date; and, where applicable, retail sales taxes and acknowledgment of addenda; the bidder's name, address, telephone number, and signature; the bidder's D/M/WBE commitment, if applicable; a State of Washington Contractor's Registration Number; and a Business License Number, if applicable. Bids shall be completed by typing or shall be printed in ink by hand, preferably in black ink. 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 forms unless otherwise specified.

Section 1-02.5 is supplemented with the following:
(Local Agency SP)

The Contracting Agency has elected to purchase the Pumps (Specification Section 22 13 29.16) on a sole source basis and has received a "not to exceed" price. A copy of the Manufacturer's "not to exceed" quote is included in Appendix E.

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

1-02.6 Preparation of Proposal

The second paragraph of Section 1-02.6 is supplemented with the following:
(June 27, 2011 APWA GSP)

4. If a minimum bid amount has been established for any item, the unit or lump sum price must equal or exceed the minimum amount stated.

5. Any correction to a bid made by interlineation, alteration, or erasure, shall be initialed by the signer of the bid.

The last paragraph of Section 1-02.6 is deleted and replaced with the following:
(June 27, 2011 APWA GSP)

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 copy of the partnership agreement shall be submitted with the Bid Form if any D/M/WBE requirements are to be satisfied through such an agreement.

A bid by a joint venture shall be executed in the joint venture name and signed by a member of the joint venture. A copy of the joint venture agreement shall be submitted with the Bid Form if any D/W/MBE requirements are to be satisfied through such an agreement.

1-02.7 Bid Deposit

Section 1-02.7 is supplemented with the following:
(Local Agency SP)

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 three lowest bidders within ten (10) days after the bid award. Bid bonds or checks of each of the three 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.

1-02.9 Delivery of Proposal

The first and second paragraphs of Section 1-02.9 are deleted and replaced with the following
(Local Agency SP)

Each Bid Proposal shall be submitted in a sealed envelope, with the Project Name and Project 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.

1-02.10 Withdrawing, Revising, or Supplementing Proposal

The second paragraph of Section 1-02.10 is deleted and replaced with the following:
(Local Agency SP)

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.

1-02.13 Irregular Proposals

Item 1 in Section 1-02.13 is revised to read as follows:
(Local Agency SP)

1. A proposal will be considered irregular and will be rejected if:

    a. The bidder is not prequalified when so required;

    b. The authorized proposal form furnished by the Contracting Agency is not used or is altered;

    c. The completed proposal form contains any unauthorized additions, deletions, alternate bids, or conditions;

    d. The bidder adds provisions reserving the right to reject or accept the award, or enter into the contract;

    e. A price per unit cannot be determined from the bid proposal;

    f. The proposal form is not properly executed;

    g. The bidder fails to submit or properly complete a subcontractor list, if applicable, as required in Section 1-02.6.

    h. The bidder fails to submit or properly complete a Disadvantaged Business Enterprise Certification, if applicable, as required in Section 1-02.6;

    i. The Bidder fails to submit written confirmation from each DBE firm listed on the Bidder's completed DBE Utilization Certification that they are in agreement with the bidders DBE participation commitment, if applicable, as required in Section 1-02.6, or if the written confirmation that is submitted fails to meet the requirements of the Special Provisions;

    j The Bidder fails to submit DBE Good Faith Effort documentation, if applicable, as required in Section 1-02.6, or if the documentation that is submitted fails to demonstrate that a Good Faith Effort to meet the Condition of Award was made;

    k. The bid proposal does not constitute a definite and unqualified offer to meet the material terms of the bid invitation, or

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

    m. The bidder fails to submit or properly complete a Bidder Responsibility Checklist as required in Section 1-02.1(3).

    n. The bidder fails to submit or properly complete a Subcontractor Responsibility Checklist for each subcontractor as required in Section 1-02.1(3).

Item 2 in Section 1-02.13 is supplemented with the following:
(Local Agency SP)

    f. If the County, for good cause, deems the bid bond inadequate or improper.

1-02.14 Disqualification of Bidders

Section 1-02.14 is supplemented with the following:
(Local Agency SP)

A Bidder will be deemed not responsible if:

1. The Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or

2. The Bidder fails to meet the Project-specific supplemental bidder responsibility criteria listed in Section 1-02.1.

1-02.15 Pre Award Information

Section 1-02.15 is revised to read as follows:
(August 14, 2013 APWA GSP)

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 Engineer or representatives of the Engineer,
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.

1-02.16 Addenda

Section 1-02.16 is added as the following:
(Local Agency SP)

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

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 Floyd Bayless, Construction Manager, at (360) 337-5631 or email fbayless@co.kitsap.wa.us. 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 Engineer 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.

END OF SECTION 1-02

1-03 Award and Execution of Contract

1-03.1 Consideration of Bids

The first paragraph of Section 1-03.1 is revised to read as follows:
(January 23, 2006 APWA GSP)

After opening and reading proposals, the Contracting Agency will check them for correctness of extensions of the prices per unit and the total price. If a discrepancy exists between the price per unit and the extended amount of any bid item, the price per unit will control. If a minimum bid amount has been established for any item and the bidder's unit or lump sum price is less than the minimum specified amount, the Contracting Agency will unilaterally revise the unit or lump sum price, to the minimum specified amount and recalculate the extension. The total of extensions, corrected where necessary, including sales taxes where applicable and such additives and/or alternates as selected by the Contracting Agency, will be used by the Contracting Agency for award purposes and to fix the Awarded Contract Price amount and the amount of the contract bond.

Section 1-03.1 is supplemented with the following:
(January 23, 2006 APWA GSP)

The Contracting Agency will consider all material submitted by the bidder to determine whether the bidder's offering is in compliance with the Contract Documents. The Contracting Agency 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.

1-03.3 Execution of Contract

Section 1-03.3 is revised to read as follows:
(Local Agency SP)

Copies of the Contract Provisions, including the unsigned Form of Contract, will be available for signature by the successful bidder following award. The number of copies to be executed by the Contractor will be determined by the Contracting Agency.

Within fourteen (14) calendar days after receipt of the Contracting Agency-prepared contract, the successful bidder shall return the signed Contracting Agency-prepared contract, an insurance certification as required by Section 1-07.18, and a satisfactory bond as required by law and Section 1-03.4. Before execution of the contract by the Contracting Agency, the successful bidder shall provide any pre-award information the Contracting Agency may require under Section 1-02.15.

Until the Contracting Agency executes a contract, no proposal shall bind the Contracting Agency nor shall any work begin within the project limits or within Contracting Agency-furnished sites. The Contractor shall bear all risks for any work begun outside such areas and for any materials ordered before the contract is executed by the Contracting Agency.

If the bidder experiences circumstances beyond their control that prevents return of the contract documents within the calendar days after the award date stated above, the Contracting Agency may grant up to a maximum of fourteen (14) additional calendar days for return of the documents, provided the Contracting Agency deems the circumstances warrant it.

1-03.4 Contract Bond

The first paragraph of Section 1-03.4 is revised to read as follows:
(October 1, 2005 APWA GSP)

The successful bidder shall provide an executed contract bond for the full contract amount. This contract bond shall:

1. Be on a Contracting Agency-furnished form;
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,
3. Be conditioned upon the faithful performance of the contract by the Contractor within the prescribed time;
4. Guarantee that the surety shall indemnify, defend, and protect the Contracting Agency against any claim of direct or indirect loss resulting from the failure:
   a. Of the Contractor (or any of the employees, subcontractors, or lower tier subcontractors of the Contractor) to faithfully perform the contract, 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;
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 must be signed by the president or vice-president, unless accompanied by written proof of the authority of the individual signing the bond to bind the corporation (i.e., corporate resolution, power of attorney or a letter to such effect by the president or vice-president).

END OF SECTION 1-03

1-04 Scope of the Work

1-04.1(2) Bid Items Not Included in the Proposal

Section 1-04.1(2) is deleted and replaced with the following:
(Local Agency SP)

When the Contract specifies Work that has no Bid Item in the Bid Proposal, that work shall be considered incidental to other items in the Bid Proposal whether specified as incidental or not in the measurement and payment descriptions for the individual Bid Items.

1-04.2 Coordination of Contract Documents, Plans, Special Provisions, Specifications, and Addenda

The second paragraph of Section 1-04.2 is revised to read as follows:
(Local Agency SP)

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

1. Change Orders,
2. Work Directives,
3. Addenda,
4. Proposal Form,
5. CSI Special Provisions,
6. WSDOT Special Provisions,
7. Contract Plans,
8. Amendments to the Standard Specifications,
9. Standard Specifications,
10. Contracting Agency's Standard Plans or Details (if any), and
11. WSDOT Standard Plans for Road, Bridge, and Municipal Construction.

1-04.3 Preconstruction Work Phase

Section 1-04.3 is added as follows:
(Local Agency SP)

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, attending a preconstruction public meeting whose purpose is to introduce the Contractor to the public impacted by the project, planning the construction activities with Kitsap County, the Construction Manager, and Design Engineer, establishing the initial survey control, preparing and delivering priority submittals for equipment, and other activities related to planning activities identified herein.

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.

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 arrangements with subcontractors and suppliers for the preparation and submittal of required documentation.

1-04.3(1) 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 Special Provisions.

1. Contractor's Management and Work Plan
2. Project Safety and Accident Prevention Program
3. COVID-19 Health and Safety Plan (CHSP)
4. Onsite Investigations
5. Preconstruction Photographs
6. Submittals
    a. Submittal Plan and Schedule
    b. Priority or Long Lead Time Material Submittals
    c. Priority Technical Submittals
        a. Dewatering Plan(s)
        b. Erosion Control Plan(s)
        c. Sheeting, Shoring, and Bracing Plan(s)
        d. Spill Prevention, Control, and Countermeasures Plan
        e. Temporary Sewage Bypass Plan(s)
7. Apply for and Obtain Contractor Furnished Permits
8. Spill Prevention, Control, and Countermeasures Plan
9. Schedules
    a. Contractor's Scheduler Qualifications
    b. Schedule of Values for Lump Sum Bid Items
    c. Contractor's Construction Schedule
10. Traffic Control Plan(s)
11. Attend Public Meeting
12. Attend EADOC Training

1-04.3(2) 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 in order to meet the contract work sequence and schedule constraints. Include the size of the work crew, description of on-site equipment, working hours, and requirements for material and equipment procurement, lay down, and storage.

4. Provide rates for craft labor likely to be used to complete the Work in accordance with Section 1-07.9(1). At a minimum, provide basic wage and benefits cost, worker's insurance costs, federal insurance costs, safety costs, and travel allowance costs, if applicable. Craft labor cost for the Contractor and all his subcontractors shall be provided.

5. Provide rates for equipment likely to be used to complete the Work. At a minimum, provide complete equipment description, hourly cost, operating cost per hour, and operated cost per hour. Equipment cost for the Contractor and all his subcontractors shall be provided.

1-04.3(3) Project Safety and Accident Prevention Program

Contractor shall prepare and submit a Safety and Accident Prevention Program. This program shall outline the anticipated hazards and safety controls necessary to safeguard Contractor's employees, the public, Kitsap County staff and Kitsap County representatives. It shall be specific to the job and site and meet federal, state and local jurisdictional requirements. The program will be reviewed for compliance with this Section prior to the start of work.

1-04.3(4) COVID-19 Health and Safety Plan (CHSP)

COVID-19 Health and Safety Plan (CHSP)

The Contractor shall prepare a project specific COVID-19 health and safety plan (CHSP). The CHSP shall be prepared and submitted as a Type 2 working drawing prior to beginning physical Work.

The Contractor shall update and resubmit the CHSP as the work progresses and new activities appear on the look ahead schedule required under Section 1-08.3(2)D. If the conditions change on the project, or a particular activity, the Contractor shall update and resubmit the CHSP. Work on any activity shall cease if conditions prevent full compliance with the CHSP.

The CHSP shall address the health and safety of all people associated with the project including Contractor's employees, Kitsap County staff, Kitsap County representatives, project staff, subcontractors, suppliers and anyone on the project site, staging areas, or yards. The plan shall contain the following minimum elements:

1. The CHSP shall identify all standards, guidance, publications, and sources on which it is based. Those standards may include references to OHSA, WISHA, and CDC publications that are current at the time the CHSP is prepared.

2. The CHSP shall identify a responsible individual from the Contractor who is responsible for implementation of the CHSP. The individual(s) contact information shall be listed in the CHSP.

3. The CHSP shall specifically identify the project for which it is applicable, and if applicable, shall address project work areas outside the project limits such as staging areas or yards.

4. The CHSP shall identify the PPE and administrative and engineered controls necessary to maintain a safe site. This includes but is not limited to: sanitation resources, screening stations, safety briefings, controlling access, and personal protective equipment (PPE) needed to protect workers from COVID-19.

5. The CHSP shall identify measures for screening and managing workers or visitors to areas identified in the CHSP. The plan shall include procedures should a person exhibit symptoms of COVID-19.

6. The CHSP shall identify how the plan will be updated as new work activities are added with each Weekly Look-Ahead schedule. The CHSP updates shall identify the number of

workers, crews, work tasks, and the degree of congestion or confinement workers will experience for the work activities in the Weekly Look-Ahead schedule.

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

COVID-19 Health and Safety Plan (CHSP) Inspection

The Contractor shall grant full and unrestricted access to the Engineer for CHSP Inspections. The Engineer (or designee) will conduct periodic compliance inspections on the project site, staging areas, or yards to verify that any ongoing work activity is following the CHSP plan. If the Engineer becomes aware of a noncompliance incident either through a site inspection or other means, the Contractor will be notified immediately (within 1 hour). The Contractor will be given 24 hours to either remedy the noncompliance incident or halt the associated work activity. If the Contractor fails to comply within 24 hours of receiving the Engineer's notification, the Engineer may suspend Work. The Contractor must satisfy the Engineer that the noncompliance incident has been corrected before the suspension will end.

1-04.3(5) Onsite Investigations

The Contractor shall perform on-site investigations in support of technical submittal preparation. See Section 1-02.4(2) for additional information. Activities include but may not be limited to the following:

Survey Control

The Contractor shall establish sufficient survey control to identify vertical and horizontal location of features identified during these on-site investigations. A minimum of two vertical control, temporary benchmarks (TBMs) shall be established for each Schedule for the entire duration of the project. Maintain and place TBMs to prevent disturbance. A registered surveyor employed by the Contractor shall be responsible for setting the TBMs.

Utility Locations

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. Locations of excavations shall be in coordinated and identified jointly by the Contractor and the Construction Manager. Proper equipment, labor, trench support methods, backfill, and asphalt patching materials shall be made available to support the operations. The Contractor shall be prepared to repair any damage caused during exploratory activities. Prior to any utility excavations, provide the Construction Manager advance notice of at least four (4) working days. All information from exploratory excavations shall be submitted to the Construction Manager within two working days after completion of said excavation. See Section 1-07.17 for further information regarding utilities and similar facilities.

1-04.3(6) Preconstruction Photographs or Video

Contractor shall perform preconstruction photo or video documentation in accordance with Section 1-05.4(6) Construction Photographs or Video.

1-04.3(7) Submittals

Prepare and submit the Submittal Control Document in accordance with Section 1-06.1.

Contractor shall provide submittals in accordance with Section 1-06.1 for all priority materials or materials that may take more than six (6) weeks to be obtained. Prior to submission of these priority or long lead time material submittals, Contractor shall attend pre-submittal meetings with the Construction Manager and Design Engineer as deemed appropriate for particular submittals.

Priority Technical Submittals

Priority technical submittals have been identified which have an impact on work activities starting immediately following Notice to Proceed for construction. The list includes but may not be limited to the following items. Should the Contractor's schedule identify a critical submittal not listed, preparation and submittal shall be performed during the preconstruction period:

1. Provide an Erosion Control Plan identifying erosion control measures to be used by the Contractor, including those already shown and specified. The Erosion Control Plan shall employ best management practices. Refer to requirements in Section 31 25 14 and Section 1-07.15 as amended by the Special Provisions.

2. Provide a Dewatering Plan, including drawings and complete design data showing methods and equipment to be utilized in dewatering, including relief of hydrostatic head, and in maintaining the excavation in a dewatered and in a hydrostatically relieved condition. The Dewatering plan shall address excavation operations for new structures and pipelines and shall comply with Section 31 23 43.

3. Provide a Sheeting, Shoring, and Bracing Plan. Information to be provided shall be prepared in accordance with Section 31 41 00 and shall, at a minimum, include the following:

    a. Design calculations and method of installation and removal of all Sheeting, Sheet Piling, Shoring, and Bracing. Calculations shall be made by a Washington State registered structural or civil engineer and shall comply with applicable requirements of the Washington State Safety Code and the rules of the WISHA Department of Labor and Industries with respect to excavation and construction.

    b. Detailed excavation support drawings.

4. Provide a Spill Prevention, Control and Countermeasures Plan per Section 1-07.15(1) as amended by the Special Provisions.

5. Provide Temporary Sewage Bypass Plan(s) in accordance with Section 01 59 00, including drawings and complete design data showing methods and equipment to be utilized to temporarily bypass sanitary sewage systems while making connections to the existing system and/or installing new facilities that require the temporary bypass of the existing facilities.

1-04.3(8) Contractor Furnished Permits

The Contractor shall apply for and obtain the Contractor Furnished Permits per Section 1-07.6(2) during the Preconstruction Work Phase.

1-04.3(9) Schedules

The Contractor shall submit the Contractor's scheduling qualifications including the resume(s) of the designated person(s) responsible for schedules and reports (the "Contractor's Scheduler"). The Contractor's Scheduler shall have demonstrable capability to plan, coordinate, execute, and monitor a CPM schedule as required for this Project. The Construction Manager will approve or reasonably disapprove the Contractor's proposed scheduler. In the event of disapproval, a new scheduler shall be proposed within one week and be subject to the same consideration criteria as noted above. In addition, 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 (CPM) prepared in accordance with Section 1-08.3.

1-04.3(10) Traffic Control Plan(s)

Contractor shall provide traffic control plan(s) in accordance with Section 1-10.2.

1-04.3(11) Attend EADOC Training

Contractor shall attend EADOC training in accordance with Section 1-12.8.

1-04.3(12) Attend Public Meeting

Contractor shall attend one evening public meeting during the Preconstruction Work Phase to be introduced to the public that may be impacted by the project and answer general construction related questions.

1-04.4 Changes

The seventh paragraph of Section 1-04.4 is revised to read as follows:
(Local Agency SP)

The Contractor shall proceed with the Work upon Receiving:

1. A written change order approved by the Engineer, or
2. A work directive from the Engineer before actually receiving the written change order.

1-04.4(2) Work Directives

Section 1-04.4(2) is added as the following:
(Local Agency SP)

Where situations involve changes in the Work that might delay the Project, if not processed expeditiously, the changed work shall be initiated through use of a Work Directive. The Work Directive is not a Change Order, but only a directive issued by the Engineer to proceed with work that may be included in a subsequent Change Order.

The Engineer initiates the form which shall include the project name, number, contract number, and Contractor name. In addition, the reason for the change and a description of the desired Work shall be included in sufficient detail to fully describe the required Work and necessity for the change. A method of payment and estimated cost shall be included along with any modifications to the Contract Time.

Once the Engineer has completed and signed the form, copies of the form and any supporting design criteria, sketches, modified drawings, or specifications attached to the form will be sent to the Contracting Agency's representative for approval. Once authorized by the Contracting Agency's representative, the Work Directive will be forwarded to the Contractor for signature and returned to the Engineer. The Contractor shall then perform the work described in the work directive.

As Work directed by the Work Directive progresses, Contractor shall submit to the Engineer any documentation required by the Work Directive on the day that work is performed for inclusion in a subsequent Change Order. Documentation may include records of force account work, material invoices, as-built data or quality control documentation.

1-04.4(3) Requests for Information

Section 1-04.4(3) is added as the following:
(Local Agency SP)

Requests for Information (RFIs) will be used by the Contractor where necessary to provide written direction to clarify or provide additional information or direction regarding the Plans and Specifications. Unless otherwise approved, the Contractor shall use a form provided by the Engineer. While the Engineer will attempt to respond to RFIs in an expeditious manner to avoid impacting the Contract Time, the Engineer shall have a minimum of five (5) working days to review and respond to RFIs. RFIs shall be used if the matter could result in a change in the contract price or time.

1-04.6 Variation in Estimated Quantities

The first paragraph of Section 1-04.6 is deleted and replaced with the following:
(May 25, 2006 APWA GSP)

Payment to the Contractor will be made only for the actual quantities of work performed and accepted in conformance with the Contract. When the accepted quantity of work performed under a unit item varies from the original proposal quantity, payment will be at the unit contract price for all work unless the total accepted quantity of any contract item, adjusted to exclude added or deleted amounts included in change orders accepted by both parties, increases or decreases by more than 25 percent from the original proposal quantity, and if the total extended bid price for that item at time of award is equal to or greater than 10 percent of the total contract price at time of award. In that case, payment for Contract Work may be adjusted as described herein.

Section 1-04.6 is supplemented with the following:
(Local Agency SP)

For certain items, quantities have been entered into the Bid Proposal only to provide a common Bid Proposal for bidders. Actual quantities will be determined in the field as the work progresses, and will be paid at the original unit bid price, regardless of final quantity. These bid items, identified by the term "allowance" in their title, shall not be subject to the price adjustment provisions of 1-04.6 of the Standard Specifications.

1-04.11 Final Cleanup

Section 1-04.11 is deleted and replaced with the following:
(Local Agency SP)

1-04.11 Cleanup

The Contractor shall be responsible for ongoing and final cleaning of the project site. The Contractor shall continually, from the first day of work on the project to the last, include in his operations sufficient personnel, equipment, and materials specifically assigned to cleanup all areas which are affected or disturbed by the work operations.

1-04.11(1) Daily Cleanup

The Contractor shall cause all disturbed areas to be cleaned of all debris and excess construction materials, to be temporarily or permanently graded and finished to smooth lines and grades, to be maintained free of dust, to control surface runoff such that there is no soil erosion or contaminated runoff onto adjacent areas or drainages, and to not have any detrimental impacts. All such cleanup shall be conducted to the satisfaction of the Contracting Agency.

The Contractor shall clean all roadways, streets, sidewalks, and other facilities of all material and debris that are dropped or otherwise deposited thereon as a result of the Contractor's operations. All such areas shall be cleaned at the conclusion of each day's operations and at such other times as ordered by the Contracting Agency.

In addition, the Contractor shall use water for dust control on paved, surfaced, or unimproved streets or roadways as may be required to prevent inconvenience to the public. The Contractor shall also use water, if necessary, to remove mud and other debris from streets and roadways.

If the roadways and facilities are not properly or promptly cleaned and the conditions so warrant, as determined by Contracting Agency, the Contractor shall provide facilities to remove soil from truck or other equipment tires or between dual wheels or outside of truck beds before trucks or equipment may be allowed to travel over streets.

1-04.11(2) Final Cleanup

The Contractor shall perform final cleanup of the project site to the satisfaction of the Contracting Agency after completion of all work and prior to Final Acceptance. Such cleanup shall include, but not be limited to, removal of all rubbish, surplus materials, construction materials, equipment, and debris. Oversize rock, stumps, brush, and other extraneous materials shall be removed from the project site and disposed of in a lawful manner.

Roadway surfaces shall be thoroughly broom cleaned and washed to remove all material or debris which was deposited on the surfaces.

Any existing fencing removed or damaged by the Contractor shall be replaced in kind and to the satisfaction of the property owner.

The Contractor shall not remove temporary warning, regulatory or guide signs until authorized to do so by the Contracting Agency.

1-04.11(3) Corrective Action

Any violation of the above requirements, as determined by the Contracting Agency, will be sufficient grounds for the Contracting Agency to order the cleanup work to be performed by others. The costs for such corrective action shall be deducted from any monies due or to become due to the Contractor.

1-04.12 Temporary Facilities

Section 1-04.12 is added as the following:
(Local Agency SP)

The Contractor shall furnish, for the duration of the project, a temporary field trailer(s) for his use as well as the Contracting Agency's use within a reasonable distance of the project site. Temporary facility installation shall meet the construction safety requirements of OSHA, State, and other governing agencies and the noise limitations shall meet the requirements in Section 1-07.5(5) in the Special Provisions. Contractor shall be responsible for providing telephones, fax machines, and copier and shall pay for installation and monthly service charges for all utilities, including telephone, copy machines, and fax machines. Provide and pay for equipment service contracts for all furnished equipment.

Upon completion of the work, and subject to approval of the Engineer, the Contractor shall completely remove all temporary facilities. Temporary utilities shall be removed to the temporary service connection point, and capped or terminated.

All disturbed surfaces shall be restored to the condition which existed prior to installation of temporary facilities or utilities. All roadway surfaces or other improvements which have been damaged by construction activities shall be repaired or replaced by the Contractor, as directed.

1-04.12(1) Space Allocation

On-site space is limited. Arrangements for additional space required for Contractor's staging and storage of materials and equipment (in addition to that allocated), shall be made for locations off site as described below.

Due to the limited space available outside project limits (and within the existing right of way and temporary construction easements), the Contractor shall make the necessary arrangements with nearby property owner(s) in order to establish an area(s) for the temporary facilities and storing of equipment and materials. All costs associated with third parties arrangements shall be considered incidental to the construction and shall be included in the costs of other items of work involved in the project.

1-04.12(2) Contractor's Work Area

Contractor shall limit operations and storage of equipment and materials to the areas designated on the Plans, unless written agreements have been obtained from third parties that allow the use of areas outside those described on the Plans. Contractor shall provide a copy of all such third party agreements to the Owner prior to using areas described by the agreement. All such agreements shall contain provisions that hold the Owner harmless from any and all damages and costs associated with the use of said areas. Contractor shall be solely responsible for the use of said areas.

Contractor shall maintain the area(s) during construction and shall proceed with the work in an orderly manner, maintaining the construction site free of debris and unnecessary equipment or materials. Material shall be stored on pallets or racks off the ground and in a manner to allow access for inspection.

1-04.12(3) Temporary Water for Construction and Testing

Contractor shall be responsible for obtaining a source of temporary water for construction and testing and potable water required by construction personnel. Provide water from off-site sources as necessary. Contractor shall determine availability and make arrangements, and pay all costs, with the local utility for temporary construction water, including metering equipment.

1-04.12(4) Temporary Electric Power

Contractor shall verify existing electric service and provide temporary electric power, if required, for use during construction. Electric power should be available at or near the site. The Contractor shall determine the type and amount available and make arrangements with the local utility for obtaining

temporary electric power service, including metering equipment. The Contractor shall provide temporary lighting at least to meet all applicable safety requirements to allow erection, application or installation of materials and equipment, and observation or inspection of the Work. Meet safety requirements of OSHA, State and other governing agencies for electrical installations. Facilities for providing temporary electric power shall meet all noise restriction requirements of Section 1-07.5(5) in the Special Provisions.

The Contractor shall provide all electrical power required for construction, testing, general and security lighting, and all other purposes whether supplied through temporary or permanent facilities.

1-04.12(5) Sanitary Facilities

The Contractor shall provide suitable chemical toilets or water closets at appropriate locations within the site of the work in compliance with the requirements of Section 1-07.4 of the Standard Specifications. Secondary containment shall be provided for each chemical toilet or water closet. At the end of the job such toilets shall be removed.

1-04.12(6) Temporary Telephone Service

Contractor shall furnish onsite telephone service to the temporary field trailer, including fax, for the duration of construction of the Contract and shall be responsible for verifying existing service and making all arrangements with the local telephone utility for providing service as required. Said services shall be provided to the construction trailer(s).

1.04.12(7) Site Access and Parking

All vehicles shall be parked in such a manner so as to not encroach on public right-of-way or be a traffic hazard. Ready access to and through the site by emergency vehicles shall be maintained at all times. The Contractor shall be responsible for control of parking by all of the Contractor's and subcontractor's work force to assure compliance. The Contractor shall anticipate that there may not be sufficient parking space for all of the work force in the construction project area. If this is the case, Contractor shall arrange for carpooling and/or off-site parking and shuttle service, as necessary.

1.04.12(8) Removal of Temporary Facilities

Upon completion of the work, and subject to approval of the Engineer, the Contractor shall completely remove all temporary facilities. Temporary utilities shall be removed to the temporary service connection point, and capped or terminated.

All disturbed surfaces shall be restored to the condition which existed prior to installation of temporary facilities or utilities. All roadway surfaces or other improvements which have been damaged by construction activities shall be repaired or replaced by the Contractor, as directed.

END OF SECTION 1-04

1-05 Control of Work

1-05.2 Authority of Assistants and Inspectors

Section 1-05.2 is supplemented with the following:
(Local Agency SP)

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.

1-05.4 Conformity With and Deviations from Plans and Stakes

Section 1-05.4 is supplemented with the following:
(Local Agency SP)

1-05.4(1) Contracting Agency-Furnished Reference Points and Surveying

The Contracting Agency has established survey control for construction purposes. This survey control information is provided on the drawings.

The Contractor shall protect and preserve survey control points and property corners. If these points or corners are disturbed by the Contractor, the Contractor shall pay all costs associated for re-establishment of the control points and property corners. The Contractor shall have the work performed by the Contractor's surveyor. Delays resulting from the destruction and re-establishment of survey control points and property corners shall not constitute the basis for additional compensation or extensions to the Contract Time.

1-05.4(2) Contractor-Furnished Surveying

The Contractor shall provide all necessary construction surveys to complete the Work as required by the Contract Documents. The Contractor shall use competent and experienced survey personnel, and suitable equipment necessary for establishing, checking, and maintaining points, lines and grades. Survey shall provide sufficient alignment and off-set control points for proper vertical and horizontal alignment, grade, station and construction of the facilities. In addition, the center point and/or corners of all structures shall be staked. Survey work shall be within the following tolerances:

1. Stationing, +/- 0.01 feet
2. Alignment +/- 0.01 feet
3. Structure elevation +/- 0.01 feet

Contractor shall employ or retain a registered Washington Land Surveyor to perform and/or oversee and direct construction surveys, as well as surveys to verify/document locations and elevations of all completed facilities for record drawings. Minor surveying, such as grade staking may be performed by the Contractor's personnel with approval of the Engineer. Contractor shall be responsible for detailed dimensions, elevations, and excavation measured from the construction staking.

The Engineer may verify the Contractor's work with spot-checks. These spot-checks do not change the requirements for normal checking and testing as specified elsewhere or the Contractor's responsibility for the work and producing a finished product that is in accordance with the Contract Documents. If errors are found, the Contractor shall correct the errors, which may include removal and replacement of incorrectly installed improvements. All costs in correcting work shall be at the Contractor's expense in accordance with Section 1-05.7.

In the event the Engineer determines the survey work is insufficient, the Contractor shall provide suitable and acceptable corrective measures immediately at no additional expense to the Contracting Agency.

1-05.4(3) Survey Submittals

Contractor shall submit the qualifications and resume(s) of the proposed survey firm and surveyor(s) along with a description of the survey efforts to be performed. Cut-sheets shall be provided to the Engineer for review a minimum of five (5) working days in advance of construction.

1-05.4(4) Survey Records

Field books shall be hard-back field books. The Contractor shall maintain on-site a copy of all field surveying records prepared by surveyor. These records shall be available for review by the Engineer upon request. At the conclusion of the work, the Contractor shall provide the Contracting Agency with a copy of the surveying records.

1-05.4(5) Resurveys

The Contractor shall direct all questions regarding interpretation of provided survey data to the Engineer. Failure to correctly interpret and utilize survey control data or plans as provided by the Engineer shall not constitute justification for a claim of extra work. The Contractor shall immediately notify the Engineer of any survey data discrepancies.

Any claim by the Contractor for extra compensation by reason of alterations or reconstruction work allegedly due to error in Contracting Agency-Furnished survey control, will not be allowed unless the original control points still exist and are proven to be incorrect, or unless other satisfactory substantiating evidence to prove the error is furnished to the Engineer.

1-05.4(6) Construction Photographs or Video

Prior to and after construction, the Contractor shall provide still photos, or alternatively, audio color video of project area and adjacent site conditions. Filming plan shall be coordinated with the Contracting Agency's Representative. Filming shall be done at reasonable intervals along the project so sufficient detail and coverage of the area is provided (e.g. approximately every 100 feet, intersections, staging areas, pump station sites, etc). Filming shall be done from differing directions, spacing, and angles to sufficiently show/depict the project area's conditions.

Photographs shall be done by a qualified commercial professional photographer. Photos shall be taken with a high-quality digital camera, with minimum 8-mega-pixel resolution.

Photographs shall be 3-inch by 5-inch color matte prints mounted on 8-1/2" by 11" cardstock, enclosed within plastic film folders, or other approved mounting. Pictures shall be logically arranged and bound in a 3-ring D binder. Photographs shall also be provided on CDs. Pictures shall have the date, location, description, direction of filming and other pertinent reference information (e.g., facing east, facing south, etc.) on or below each image. Submit sample for review and approval in advance of producing bound document.

Video shall be done by qualified commercial professional photographer. Video equipment shall be a high quality digital recorder. The video shall contain an audio track which narrates the progression of the video through the project area/site. Recording shall display index counter, date and time of recording.

The pre-construction photos or video shall be performed prior to commencement of the work and after initial staking of the project and construction limits. Post construction photos shall be taken at final completion of the work. Post construction filming locations shall be similar to preconstruction filming locations. Submit 1 copy of photographs and CDs to the Engineer.

1-05.4(7) Existing Markers and Monuments

Contractor shall take necessary precautions to locate and protect existing markers, property corners, monuments, section corners, subdivision corners, plat markers, bench marks, and all other reference points that may be affected by construction. All markers that may be disturbed by construction shall be identified, referenced, and replaced if disturbed in accordance with recognized surveying practices. Property corners, fences and other indications of property lines shall be referenced by the Contractor prior to construction and reset after completion of the construction operations in accordance with recognized survey practices.

Contractor shall not knowingly remove or disturb any such marker before a licensed land surveyor can reference such marker. Contractor shall be responsible for providing said survey services and shall be responsible for all costs for replacing markers and recording of surveys. Contractor will not be entitled to any delay costs for referencing an existing marker.

In the event that any of these items are not replaced by the Contractor, they shall be replaced by Engineer and the cost of this work shall be billed to the Contractor by the Contracting Agency.

1-05.4(8) Re-establishment of Existing Markers and Monuments

If a marker or monument must be disturbed, Contractor shall follow these steps in accordance with recognized survey practices:

1. Survey work associated with WAC 332-120 shall be performed for the removal and resetting of monuments.
2. Before Contractor disturbs monument(s), surveyor shall establish reference points to perpetuate the position of the monument(s) and an Application For Permit to Remove or Destroy a Survey Monument shall be filed with the Department of Natural Resources (DNR) as set forth in WAC 332-120, for all existing monuments that are subject to being disturbed, prior to construction of improvements.
3. Once a permit has been authorized by DNR, the Contractor may excavate monument(s).
4. The Contractor shall provide replacement monuments as shown on the Plans or as required by the County.
5. The Contractor shall set replacement monument, case, and cover in position.
6. Surveyor shall verify the position and punch mark the brass cap.
7. Surveyor shall file Completion Report for Monument Removal and Destruction with the Department of Natural Resources upon completion of monument replacement.

The Contractor shall be responsible for removal and resetting of markers and monuments.

1-05.5 Project Record Drawings

Section 1-05.5 is added as the following:
(Local Agency SP)

The Contractor shall maintain two sets of full size drawings and specifications for the Contract on site during the construction that shall be accessible for review by the Contracting Agency and the Engineer at all times. The Contractor's superintendent or authorized representative shall update the documents with clear and accurate red-lined field revisions and record information on a daily basis and within two (2) business days after receipt of information that a change in Work has occurred. The quality of the Record Drawings, in terms of accuracy, clarity, and completeness, shall be adequate to allow the Contracting Agency to modify the computer-aided drafting (CAD) Contract Drawings to produce a complete set of Record Drawings for the Contracting Agency without further investigative effort by the Contracting Agency.

The Record Drawing markups shall document all changes in the Work, both concealed and visible and shall be legible and accurately marked to indicate modifications in the completed work that differ from the design information shown on the Contract Plans. The Contractor shall not conceal any Work until the required information is recorded. Items that must be shown on the markups include, but are not limited to:

1. Actual dimensions, arrangement, and materials used when different than shown in the Plans.
2. Changes made by Change Order or Work Directive.
3. Changes made by the Contractor.

4. Accurate locations of storm sewer, sanitary sewer, water mains, and other water appurtenances, underground power and telephone, gas lines, structures, conduits, light standards, vaults, width of roadways, sidewalks, landscaping areas, building footprints, channelization and pavement markings, etc. Include pipe invert elevations, top of castings, (manholes, inlets, etc.).

As-built surveying/staking provided by the Contractor shall meet the following tolerance limits:

	Vertical	Horizontal
As-built sanitary & storm invert and grate elevations	± 0.01 foot	± 0.01 foot
As-built monumentation	± 0.001 foot	± 0.001 foot
As-built waterlines, inverts, valves, hydrants	± 0.10 foot	± 0.10 foot
As-built ponds/swales/water features	± 0.10 foot	± 0.10 foot
As-built buildings (fin. Floor elev.)	± 0.01 foot	± 0.10 foot
As-built gas lines, power, TV, Tel, Com	± 0.10 foot	± 0.10 foot
As-built signs, signals, etc.	N/A	± 0.10 foot

Redline entries on the Record Drawings shall conform to the following standard:

1. Use erasable colored pencil (not ink) for all markings on the Record Drawings, conforming to the following color code:
2. Additions - Red
3. Deletions - Green
4. Comments - Blue
5. Dimensions - Graphite
6. Provide the applicable reference for all entries, such as the change order number, the request for information (RFI) number, or the approved shop drawing number.
7. Date all entries.
8. Clearly identify all items in the entry with notes similar to those in the Contract Drawings (such as pipe symbols, centerline elevations, materials, pipe joint abbreviations, etc.).

The Record Drawings shall be used for this purpose alone, shall be kept separate from other Plan sheets, and shall be clearly marked as Record Drawings. One set shall be submitted to the Engineer monthly along with the Contractor's request for progress payments. Failure to supply the record drawings each month or failure of the record drawings to reflect the above information in a clear and concise manner shall be basis for withholding the Contractor's Progress Payments until such time as they are completed to the satisfaction of the Engineer. Upon completion of review of the drawings, the Engineer shall either return the set of record drawings to the Contractor for continued use or may provide a new, unused set of documents for the Contractor's use.

Upon completion of all the work and prior to final acceptance, one or both of the sets of record drawings and specifications shall be delivered to the Engineer along with a copy of all supporting information. The Contractor shall certify on the Record Drawings that said drawings are an accurate depiction of built conditions, and in conformance with the requirements detailed above.

1-05.5(1) Project Electronic Data and Information

Electronic submittals shall conform to Section 1-12. This may include RFIs, Work Directives, Project Data Submittals/Shop Drawings, and other project correspondence. Protocol and requirements shall be discussed and worked out with the Contracting Agency and Engineer in advance. Electronic data and information shall be in a PDF format that conforms to Section 1-06.1(3). Due to security and other IT

system constraints, file sizes may be limited. Contractor shall provide paper copies at the request of the Contracting Agency or Engineer.

Once the Contract is awarded, the Contracting Agency will grant the Contractor access to their EADOC software for the Contractor's use on this project. No user fees will be charged to the Contractor for this software. All costs for the training and use of this software shall be considered incidental to the Contract.

1-05.7 Removal of Defective and Unauthorized Work

Section 1-05.7 is supplemented with the following:
(October 1, 2005 APWA GSP)

If the Contractor fails to remedy defective or unauthorized work within the time specified in a written notice from the Engineer, or fails to perform any part of the work required by the Contract Documents, the Engineer may correct and remedy such work as may be identified in the written notice, with Contracting Agency forces or by such other means as the Contracting Agency may deem necessary.

If the Contractor fails to comply with a written order to remedy what the Engineer determines to be an emergency situation, the Engineer may have the defective and unauthorized work corrected immediately, have the rejected work removed and replaced, or have work the Contractor refuses to perform completed by using Contracting Agency or other forces. An emergency situation is any situation when, in the opinion of the Engineer, a delay in its remedy could be potentially unsafe, or might cause serious risk of loss or damage to the public.

Direct or indirect costs incurred by the Contracting Agency attributable to correcting and remedying defective or unauthorized work, or work the Contractor failed or refused to perform, shall be paid by the Contractor. Payment will be deducted by the Engineer from monies due, or to become due, the Contractor. Such direct and indirect costs shall include in particular, but without limitation, compensation for additional professional services required, and costs for repair and replacement of work of others destroyed or damaged by correction, removal, or replacement of the Contractor's unauthorized work.

No adjustment in contract time or compensation will be allowed because of the delay in the performance of the work attributable to the exercise of the Contracting Agency's rights provided by this Section.

The rights exercised under the provisions of this section shall not diminish the Contracting Agency's right to pursue any other avenue for additional remedy or damages with respect to the Contractor's failure to perform the work as required.

1-05.8 Coordination with Owner and Adjacent Homes

Section 1-05.8 is added as the following:
(Local Agency SP)

Access to homes and business shall be maintained at all times. To maintain access to homes and businesses during the contract, the contractor shall observe the following requirements:

1. Post signs and notify homes and businesses at least five (5) working days ahead of any construction that may impact their access.
2. Provide alternate access as required to affected homes and businesses.
3. Provide a Traffic Control Plan prior to construction as described in Section 1-10 and keep it updated as construction progresses.

Maintaining access to homes and businesses shall be considered incidental to the Contract and included in other bid items. No separate payment shall be made.

1-05.10 Guarantees

Section 1-05.10 is deleted and replaced with the following:
(Local Agency SP)

In addition to any special warranties provided elsewhere in the Project Documents, the Contractor warrants to the Contracting Agency that materials and equipment furnished under the Contract will be of

good quality and new unless otherwise required or permitted by the Project Documents, and that the Work will conform to the requirements of the Project Documents as described herein. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective and may be rejected. The Contractor's warranty excludes remedy for damage caused by abuse, improper or insufficient maintenance, or improper operation. If required by the Contracting Agency's Representative or Contracting Agency, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment provided.

Neither final acceptance by the Contracting Agency nor partial and final payment nor any provision in the Contract Documents shall relieve the Contractor of responsibility for faulty materials or workmanship.

If, prior to the expiration of one year after the date of final acceptance of all work or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any work (including materials and equipment) that is found to be defective or not in compliance with the Contract Documents, the Contractor shall promptly, without cost to Contracting Agency, either correct such work, or, if it has been rejected by Contracting Agency, remove and replace it with acceptable work. If the Contractor does not promptly comply with the notification issued by the Contracting Agency for correction of defective and/or non-complying work, the Contracting Agency may have the Work corrected or removed and replaced and all direct and indirect costs of such removal and replacement, including costs of all professional services, shall be paid by Contractor as provided for herein.

Actual or alleged knowledge by the Contracting Agency, Engineer and/or inspector(s), prior to acceptance of all work by the Contracting Agency, of defects or deficiencies in the Work shall not, in any way, affect or diminish the guarantee by the Contractor. The guarantee shall apply to all elements and parts of the Work, regardless of knowledge by the Contracting Agency, Engineer and inspector(s) of defects or deficiencies and regardless of failure of the Contracting Agency, Engineer and/or inspector(s) to inform the Contractor of known or suspected defects or deficiencies prior to final acceptance of the Work by the Contracting Agency.

All subcontractor's, manufacturers', and suppliers' warranties and guarantees, express or implied, for any part of the Work, materials and equipment shall be deemed obtained and shall be enforced by the Contractor for the benefit of the Contracting Agency without the necessity of formal transfer or assignment thereof. Warranties and guarantees by subcontractors, manufacturers, and suppliers shall begin on and extend for one year after the date of final acceptance by the Contracting Agency of all work.

All work (including materials and equipment) repaired or replaced in accordance with this Section shall be guaranteed for a period of one year after the date of acceptance by the Contracting Agency of the repair/replacement work.

Nothing contained in these provisions 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 the Contractor in the hands of the Contracting Agency.

These guarantee provisions shall be inserted in all subcontracts and material contracts, and notice of these provisions shall be given to all persons furnishing materials for the Work when no formal contract is entered into for such materials.

1-05.11 Final Inspection

Section 1-05.11 is deleted and replaced with the following:
(Local Agency SP)

1-05.11 Facility Startup, Testing and Training

Contractor shall provide complete startup and testing/commissioning to ensure that equipment and mechanical, electrical, controls and special controls and instrumentation systems are properly installed and function, operate, and perform as intended and required. Contractor shall submit a startup and testing plan showing how the testing will be accomplished for review and acceptance by the Engineer prior to commencing startup and testing of the facilities.

All mechanical and electrical equipment shall be tested by the Contractor before any system is put into operation. Testing procedures shall be designed to duplicate as nearly as possible all conditions of operations and shall be carefully selected to ensure that the equipment is not damaged. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned and connected. Any changes, adjustments or replacements required to make the equipment operate as required shall be carried out by the Contractor or a qualified technician of the seller or equipment representative as part of the work.

Before startup, the Contractor shall properly lubricate all bearings and other items which normally require lubrication and fill each gear case and oil reservoir to the proper operating level, using the equipment manufacturer's supplied lubricant. If any equipment or system does not operate properly, the Contractor shall immediately replace or repair components until it operates properly. When the equipment start-up is complete, the Contractor shall submit a start-up and testing report to the Engineer.

Copies of field test reports shall be signed by the Contractor and provided to the Engineer along with the testing report.

Initial start up and testing or commissioning services shall include a minimum of one (1) 8-hour day(s).

System Startup and Testing General Requirements shall include the following:

1. Following initial start up and testing, the entire system shall be required to undergo a 10-day startup period in the presence of the Contracting Agency and Engineer. Any equipment failing or malfunctioning during this 10-day period shall be repaired or replaced, and when it is once again operational, shall be required to undergo a full 10-day startup period. Acceptance of the work and equipment will occur only after successful completion of the 10-day startup period.
2. The Contractor will supervise and be responsible for the proper maintenance and care of the equipment during the startup period and a succeeding 10-day period after successful startup.
3. When a motor, pump, valve, meter, instrument, or other item of equipment does not operate properly, adjustments shall be made by an experienced technical representative of the manufacturer.
4. If adjustments fail to correct the operation of a piece of equipment, remove and replace it with a suitable replacement that meets the operating requirements.

All components shall be calibrated by the Contractor after completion of installation. Components that cannot be properly calibrated or are found to exceed the specified range or accuracy shall be removed and replaced.

Contractor is responsible for determining that all equipment and all systems are functioning properly by start-up time. Prior to startup, the Contractor shall furnish documentation that the equipment provided is installed and is functioning in compliance with the manufacturer's recommended specification and instructions.

The Contractor shall anticipate that the Contracting Agency may delay acceptance of all work under the Contract if, in the judgment of the Contracting Agency, malfunctions or failures in operation of the system repeatedly occur after startup. The Contractor shall not be entitled to an extension of time or to any claim for damages because of hindrances, delays, or complications caused by or resulting from delay by the Contracting Agency in accepting the work because of malfunctions or failures in operation of the system.

Immediately prior to final acceptance, Contractor shall make a final check of all lubrication requirements and leave all equipment properly lubricated, ready for Contracting Agency's use.

The Contractor shall demonstrate to the Contracting Agency's personnel, the proper manner of maintaining the equipment, making adjustments, and maintaining the system. Work performed by the manufacturer's representative required for startup will not be considered as operator training even if the operators are present and witnessing the adjustments. Equipment startup will be completed before the

required on-the-job operator training begins. Operator training services shall include a minimum of two (2) 8-hour days.

1-05.11(1) Substantial Completion

When the Contractor considers the work to be substantially complete, the Contractor shall so notify the Engineer and request the Engineer establish the Substantial Completion Date. The Contractor's request shall list the specific items of work that remain to be completed in order to reach physical completion. The Engineer will schedule an inspection of the work with the Contractor to determine the status of completion and prepare a punch list of unresolved items. If the number of unresolved items exceeds 20, the Engineer may stop the inspection and notify the Contractor that the project is not ready for the Substantial Completion Inspection. The list of unresolved items shall be provided by the Engineer to the Contractor within 10 working days of the Contractor's request for Substantial Completion. The Engineer may also establish the Substantial Completion Date unilaterally. The Contractor will not be allowed an extension of contract time because of a delay in the performance of the work attributable to the exercise of the Engineer's right hereunder.

If the Engineer concurs with the Contractor that the work is substantially complete and the facilities can be used safely and are ready for the intended use, the Engineer, by written notice to the Contractor, will set the Substantial Completion Date. If, after this inspection the Engineer does not consider the work substantially complete and ready for its intended use, the Engineer will, by written notice, so notify the Contractor giving the reasons therefore.

Upon receipt of written notice concurring in or denying substantial completion, whichever is applicable, the Contractor shall pursue vigorously, diligently and without unauthorized interruption, the work necessary to reach Substantial and Physical Completion. The Contractor shall provide the Engineer with a revised schedule indicating when the Contractor expects to reach substantial and physical completion of the work.

The above process shall be repeated until the Engineer establishes the Substantial Completion Date and the Contractor considers the work physically complete and ready for final inspection.

1-05.11(2) Operational Testing

It is the intent of the Contracting Agency to have a complete and operable system prior to establishing the Substantial Completion Date. Therefore, when the work involves the installation of process, mechanical and electrical systems, the Contractor will be required to operate and test these systems for a period of time prior to the Substantial Completion Date. Process and mechanical equipment, electrical controls, meters, or other devices and equipment to be tested during this period, shall be tested under the observation of the Contracting Agency or Engineer. Where such operational testing is required, the systems shall be tested under operating conditions for a reasonable period of time, but no less than the number of days stipulated, to assure their proper operation and function prior to establishing the Substantial Completion Date. During and following the test period, the Contractor shall correct any items of workmanship, materials, or equipment which do not meet the requirements of the Contract Documents, prove faulty, or that are not in good operating condition. Equipment that repeatedly breaks down or fails to operate or perform properly during this operational testing period will be cause to extend the testing period. The Substantial Completion Date will not be established until the necessary corrections and tests have been completed to the satisfaction of the Engineer and Contracting Agency.

The costs for equipment, labor, materials, supplies, power, gas, water, and everything else needed to successfully complete operational testing shall be included in the unit contract prices related to the system being tested, unless specifically set forth otherwise in the proposal.

Operational and test periods shall not affect a manufacturer's guaranties or warranties furnished under the terms of the contract.

1-05.11(3) Final Inspection and Physical Completion

When the Contractor considers the work physically complete and ready for final inspection, the Contractor, by written notice, shall request the Engineer to schedule a final inspection. The Engineer will set a date for final inspection. The Engineer and the Contractor will then make a final inspection and the

Engineer will notify the Contractor in writing of all particulars in which the final inspection reveals the work incomplete or unacceptable. If the number of unresolved items exceeds 20, the Engineer may stop the inspection and notify the Contractor that the project is not ready for the Physical Completion Inspection.

The Contractor shall immediately take such corrective measures as are necessary to remedy the listed deficiencies. Corrective work shall be pursued vigorously, diligently, and without interruption until physical completion of the listed deficiencies. This process will continue until the Engineer is satisfied the listed deficiencies have been corrected.

If action to correct the listed deficiencies is not initiated within 7 days after receipt of the written notice listing the deficiencies, the Engineer may, upon written notice to the Contractor, take whatever steps are necessary to correct those deficiencies pursuant to Section 1-05.7.

The list of unresolved items shall be provided by the Engineer to the Contractor within 10 working days of the Contractor's request for Physical Completion. The Contractor will not be allowed an extension of contract time because of a delay in the performance of the work attributable to the exercise of the Engineer's right hereunder.

Upon correction of all deficiencies, the Engineer will notify the Contractor and the Contracting Agency, in writing, of the date upon which the work was considered physically complete. That date shall constitute the Physical Completion Date of the contract, but shall not imply acceptance of the work or that all the obligations of the Contractor under the contract have been fulfilled.

1-05.12 Final Acceptance

The first paragraph of Section 1-05.12 is deleted and replaced with the following:
(Local Agency SP)

The Contractor must perform all the obligations under the contract before a completion date and final acceptance can occur. Failure of the Contractor to perform all the obligations under the contract shall not bar the Contracting Agency from unilaterally accepting the contract as provided in Section 1-09.9. The Contracting Agency, or a duly authorized representative, accepts the completed contract and the items of work shown in the Comparison of Quantities by signature of the Notice of Completion and Acceptance. The date of that signature constitutes the acceptance date. Progress estimates or payments shall not be construed as acceptance of any work under the contract.

1-05.12(1) One-Year Guarantee Period

Section 1-05.12(1) is added as the following:
(Local Agency SP)

The Contractor shall return to the project and repair or replace all defects in workmanship and material discovered within one year after Final Acceptance of the Work, except that the submersible pumps' guarantee shall be for five years as stipulated in Section 22 13 29.16 of these specifications. The Contractor shall start work to remedy any such defects within 7 calendar days of receiving Contracting Agency's written notice of a defect, and shall complete such work within the time stated in the Contracting Agency's notice. In case of an emergency, where damage may result from delay or where loss of services may result, such corrections may be made by the Contracting Agency's own forces or another contractor, in which case the cost of corrections shall be paid by the Contractor. In the event the Contractor does not accomplish corrections within the time specified, the work will be otherwise accomplished and the cost of same shall be paid by the Contractor.

When corrections of defects are made, the Contractor shall then be responsible for correcting all defects in workmanship and materials in the corrected work for one year after acceptance of the corrections by Contracting Agency.

This guarantee is supplemental to and does not limit or affect the requirements that the Contractor's work comply with the requirements of the Contract or any other legal rights or remedies of the Contracting Agency.

1-05.13 Superintendents, Labor, and Equipment of Contractor

Delete the sixth and seventh paragraphs of Section 1-05.13 is revised to read as follows:
(August 14, 2013 APWA GSP)

1-05.13(1) Emergency Contact List

The second sentence in the first paragraph of Section 1-05.13(1) is revised to read as follows:
(Local Agency SP)

The list shall include, at a minimum, the Prime Contractor's Project Manager, or equivalent, the Prime Contractor's Project Superintendent, and the Erosion and Sediment Control (ESC) Lead.

1-05.14 Cooperation with Other Contractors

Section 1-05.14 is supplemented with the following:
(Local Agency SP)

The Contractor shall not cause unnecessary hindrance or delay to others working in the project area. If the performance of any contract for the project is likely to be interfered with by the simultaneous performance of other contracts, the Contracting Agency and Engineer will decide which Contractor shall cease work temporarily and which Contractor shall continue, or whether the work under the contracts can be coordinated so that the contractors may proceed simultaneously.

On questions concerning conflicting interest of contractors performing related work, the decision of the Contracting Agency and Engineer shall be binding upon all contractors concerned and the Contracting Agency, the Engineer, the Contracting Agency's Representative, and their consultants shall not be responsible for damages suffered or extra costs incurred by the Contractor resulting directly or indirectly from the award, performance, or attempted performance of other contracts in the project area or caused by a decision or omission of the Contracting Agency and Engineer regarding the order of precedence in the performance of the contracts.

If, through acts of neglect on the part of the Contractor, other parties suffer loss or damage in their Work, the Contractor agrees to settle with such others by agreement or arbitration, if such others will so settle. If such others assert any claim against the Contracting Agency, the Engineer, the Contracting Agency's Representative, or their consultants on account of damage alleged to have been so sustained, the Contracting Agency shall notify the Contractor, who shall hold harmless, indemnify, and defend the Contracting Agency, Engineer, the Contracting Agency's Representative, and their consultants, and each of their directors, officers, employees, and agents against any such claim, including all attorney's fees and any other costs incurred by the indemnified parties relative to any such claim.

The Contractor shall coordinate his work with other contractors, public agencies, property owners, and utility companies which may have facilities or be working in the project area to minimize mutual interference. The Contractor shall cooperate with the utility companies and/or their subcontractors and conduct his operations in a manner that the necessary construction of their facilities can be accomplished to the mutual satisfaction of the Contracting Agency and the utility companies.

He shall also coordinate his activities with the Contracting Agency; and no water or sewer mains, individual water or sewer services, street, or private driveways may be closed off without a minimum five (5) working days' notice to the Contracting Agency and the private property owner. Should the property owner or the Contracting Agency have reasonable reason, as determined by the Engineer, to avoid access or water or sewer service shutoff at the scheduled time, the Contractor shall reschedule his work to meet the new condition.

The Contractor shall maintain overall coordination for the execution of the work. Based on the Construction Schedule prepared in accordance with these Specifications, the Contractor shall obtain from each subcontractor a similar schedule and shall be responsible for all parties maintaining these schedules or for coordinating required modifications.

1-05.15 Method of Serving Notices

The second paragraph of Section 1-05.15 is revised to read as follows:
(March 25, 2009 APWA GSP)

All correspondence from the Contractor shall be directed to the Project Engineer. All correspondence from the Contractor constituting any notification, notice of protest, notice of dispute, or other correspondence constituting notification required to be furnished under the Contract, must be in paper format, hand delivered or sent via mail delivery service to the Project Engineer's office. Electronic copies such as e-mails or electronically delivered copies of correspondence will not constitute such notice and will not comply with the requirements of the Contract.

1-05.17 Oral Agreements

Section 1-05.17 is added as the following:
(October 1, 2005 AWPA GSP)

No oral agreement or conversation with any officer, agent, or employee of the Contracting Agency, either before or after execution of the contract, shall affect or modify any of the terms or obligations contained in any of the documents comprising the contract. Such oral agreement or conversation shall be considered as unofficial information and in no way binding upon the Contracting Agency, unless subsequently put in writing and signed by the Contracting Agency.

END OF SECTION 1-05

1-06 Control of Materials

1-06.1 Approval of Materials Prior to Use

Section 1-06.1 and its associated subsections are deleted and replaced with the following: (Local Agency SP)

All equipment, materials, and articles incorporated into the permanent work:

1. Shall be new, unless the Special Provisions permit otherwise;
2. Shall meet the requirements of the Contract Documents and be reviewed by the Construction Manager prior to use;
3. May be inspected or tested at any time during their preparation and use; and
4. Shall not be used in the work if they become unfit even after being previously approved.

Prior to use, the Contractor shall assemble and submit to the Contracting Agency, Project Data and Shop Drawings for all proposed materials. The Contractor shall prepare and update on at least a monthly basis a submittal control document that indicates the status of all submittals. The status report shall be initially developed to identify all shop drawing and submittal data to be assembled and submitted by Contractor for Engineer's review.

The Contractor is cautioned that equipment and materials for which submittals are required, and which are constructed, installed, or incorporated prior to Engineer's review is at Contractor's risk. Such equipment or materials may be rejected by the Contracting Agency, and if rejected, shall be removed and replaced by the Contractor if so ordered by the Engineer at the Contractor's expense.

1-06.1(1) Contractor Responsibility for Submittals

The Contract Drawings were developed to provide a general description of the work. These drawings do not and are not intended to provide all the details of each and every element of the work. The Contractor shall be responsible for, and prepare (or have prepared), all shop and working drawings required to supplement the Contract Drawings to establish the necessary details for construction.

Supplemental shop and working drawings shall be prepared by the Contractor as required by these Special Provisions. Supplemental shop and working drawings shall include, but not be limited to: metal fabrication plans and details, erection plans and details, masonry layout plans and details, reinforcing steel plans and details, shoring plans and details, concrete formwork plans and details, equipment installation plans and details, piping layout and support plans and details. The Contractor shall be fully and completely responsible for the accuracy of the dimensions and details of the supplemental shop and working drawings, including those prepared by subcontractors, suppliers, and detailers and for full and complete conformity with the defined and implied intent of the Contract Documents. The Contractor shall check all shop drawings to make sure they conform with the Contract Documents, and in the case of re-submittals, that all review comments have been addressed prior to transmittal.

The Contractor shall coordinate between suppliers to verify that equipment, mechanical, electrical, structural elements, and other parts of the work correctly interface. The Contractor shall check and verify field dimensions of new and existing work as needed to ensure that shop drawings and other submittals are correctly dimensioned. Catalog cut sheets shall be clearly marked or notated as to which items are intended to be supplied. The Contractor's shop drawings and submittals that have been carelessly or improperly prepared and clearly not reviewed by the Contractor will be returned un-reviewed.

The Contractor shall prepare and timely transmit submittals so as not to delay the construction schedule. The Contractor is responsible for the timeliness of submittals prepared by his suppliers and subcontractors. The Contractor shall anticipate the time required for review and possible re-submittals, and shall include reasonable amounts of time for preparation, distribution and review of submittals in the construction schedule. The Contracting Agency and Engineer shall process submittals expeditiously and endeavor to complete reviews as quickly as possible, but is under no obligation to waive procedures or expedite processing because of untimely submittals by the Contractor.

By approving and submitting shop drawings, product data and samples, the Contractor represents that he/she has determined and verified all materials, field measurements, and field construction criteria related thereto, and that he/she has checked and coordinated the information contained within such submittals with the requirements of the work and Contract Documents, including with associated subcontractors, and is fully satisfied that they conform to the Contract Documents.

The Contract Price shall include the cost of furnishing all shop drawings, product data and samples, and the Contractor will be allowed no extra compensation for such drawings, product data or samples.

1-06.1(2) Limitations of Engineer's Submittal Reviews

Engineer's review and acceptance will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Corrections or comments made on the project data submittals and shop drawings during this review do not relieve the Contractor from his/her obligation to perform fully all contract requirements. Contractor is not entitled to rely upon the corrections or comments made on the project data submittals and shop drawings during this review. The review by the Engineer of project data and shop drawings is only for conformance with the general design concept of the project, and does not extend to consideration of specific dimensions, structural integrity, safety, detailed installation and construction requirements, or any other obligation of the Contractor. The review by the Engineer is for the benefit of the Owner only. Any action shown is subject to the requirements of the Contract Documents. Neither the review of the Contractor's submittal nor the corrections or comments provided herein, shall create any duty owed to or a cause of action in favor of the Contractor or any Subcontractor.

Engineer's review and acceptance will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and acceptance of a separate item as such will not indicate acceptance of the assembly in which the item functions.

Engineer's review and acceptance of required Shop Drawings or Samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Section 1-06.1(4) of the Special Provisions, and Engineer has given written acceptance of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and acceptance shall not relieve Contractor from responsibility for complying with the requirements of Section 1-06.1(3) of the Special Provisions.

Engineer's check and review of Shop Drawings and Samples, Standard Specifications and descriptive literature submitted by Contractor will be only for general conformance with design concept, except as otherwise provided, and shall not be construed as:

1. Permitting any departure from the Contract Requirements;
2. Relieving the Contractor of the responsibility for any error in details, dimensions or other issues that may exist in such submittals;
3. Constituting a blanket acceptance of dimensions, quantities, or details of the material or equipment shown; or
4. Approving departures from additional details or instructions previously furnished by Engineer. Such check or review shall not relieve Contractor of the full responsibility of meeting all of the requirements of the Contract Documents.

1-06.1(3) Submittal Procedures and Requirements

The Contractor shall transmit each submittal to the Engineer using a transmittal form provided by the Engineer. The Contractor shall certify that the contents of the submittal have been checked by the Contractor for conformance with the requirements of the Contract Documents. Submittals will not be reviewed without this certification. If it appears to the Engineer that the submittal has not been checked

by the Contractor, no further review will occur and it will be deemed incomplete and returned to the Contractor with a determination of “Revise and Resubmit”.

Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:

1. All field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
2. The suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;
3. All information relative to Contractor’s responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and
4. Shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

A separate form shall be used for a given specification section. That is, only an item or items that pertain to a given section shall be listed. Different items within a given section shall be listed.

All submittals shall be transmitted to the Engineer via the Contractor. Submittals direct from subcontractors or suppliers will not be accepted. Any communications which may occur between the Engineer and subcontractors and suppliers shall not be construed as binding on the Engineer, Contracting Agency or Contractor unless formalized in accordance with procedures set forth in the Contract Documents.

Approved File Formats

Submittals shall be Adobe PDF file format, version 8.0 or greater.

1. Bookmark all chapters, sections, and drawings.
    a. Bookmarks shall include a logical description of the chapter or section or the title and number of the drawing.
2. Format shall be standard letter 8.5” x 11" for text and/or 11” x 17” landscape for drawings.
3. Acceptable fonts include:
    a. Arial
    b. Verdana
    c. Helvetica,
    d. Times New Roman
4. Font sizes for text-based documents must be no less than 10 pt and no greater than 14 point for general text and no less than 12 pt and no greater than 18 pt for headers.
5. Font color must be black.
6. Text decoration, such as bold and italic, may only be used to emphasize key points.
7. Hyperlinks and graphics within the file is encouraged when appropriate.
8. Hyperlinks must use relative addressing.
9. Hyperlinks to information outside the primary domain of the client's intranet are unacceptable.
10. File names shall be in English, clearly convey the information contained in the file, and shall not exceed 100 characters in length. Only standard abbreviations may be used in file names.

11. Scanned documents are unacceptable.

12. Files shall not be password protected.

Each submittal shall be numbered consecutively, i.e. 1, 2, 3, etc. Assign re-submittals the same number as the original with a suffix of a sequential letter to denote it as a re-submittal. For example, the first re-submittal of submittal 25 would be 25A. Include only those items previously issued under the original submittal in re-submittals. Do not combine new submittals with re-submittals.

Where contents of submitted literature from manufacturers include data not pertinent to the submittal, the Contractor shall clearly indicate which item(s) or portion of the contents is provided and is to be reviewed by the Engineer.

The project data must be submitted in accordance with the instructions or the submittal may be returned without review, and the Contractor will not be entitled to any increase in Contract time. The Engineer will, upon completion of the review, return the transmittal form and a PDF copy of the submittal project data to the Contractor.

Engineer's review will be completed within ten (10) working days after receipt by Engineer of each complete submittal in proper sequence and will be returned to Contractor with one of the following markings:

1. "No Exceptions" indicates submittal has been reviewed and appears to be in conformance with requirements of the Contract Documents.

2. "Make Corrections Noted" indicates submittal appears to be in general conformance with requirements of the Contract Documents but requires some corrections. Contractor shall incorporate the corrections noted. No re-submittal is required.

3. "Revise-Resubmit" indicates submittal does not appear to be in conformance with the Contract Documents. Engineer's comments will be noted on the submittal or in a separate letter. Contractor shall recheck, make necessary revisions, and resubmit.

4. "Reference" or "For Information Only" indicates submittal gives general information incidental to, but not required for, review or acceptance by the Engineer.

5. "Submittal Not Required-No Action Taken" indicates that the submittal is not called for by the Contract Documents and that no action was taken by Engineer on the submittal.

The Contractor shall submit to the Contracting Agency, to demonstrate compliance with applicable safety and environmental regulations, copies of any safety and accident prevention or pollution control and/or environmental monitoring plans applicable to the project and required of the Contractor by law, as well as any on-site safety program measures applicable to the Contracting Agency or its agents or members of the public visiting the work area. When such documents require approval by a government agency, the Contractor shall also furnish evidence of approval. These submittals are informational and any comment or lack of comment by the Contracting Agency or Engineer thereon shall not be construed as either acceptance or rejection of these documents, which shall be a matter for agencies having jurisdiction.

If the Contractor fails to make the proper changes to the submittal and the Engineer is required to review a submittal more than three (3) times, the Contracting Agency may deduct the costs for subsequent reviews from the Contract Price.

1-06.1(4) Submittal Variations

Variations from the Contract Document are not allowed without prior acceptance by the Engineer and shall be made at no additional cost to the Contracting Agency or extension of the contract time unless accepted by a change order. Contractor shall give Engineer specific written notice of any such variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. The variations shall be specifically identified on each Shop Drawing or Sample submitted to Engineer for review and acceptance and shall direct specific attention to each deviation from the Contract Documents and state any trades, dimension, functions, or other aspects of the work that will be affected by the proposed change. Otherwise, the Contractor will not be relieved of the responsibility of executing the

Work in accordance with the Contract Documents, even though such Shop Drawings or Samples have been otherwise reviewed.

The Contractor is responsible for the design of any construction changes resulting from any such deviation, for dimensions which shall be confirmed and coordinated at the job site, for fabrication processes and techniques of construction, for coordination of the work with that of all trades and for a complete installation which will function as intended and originally specified.

If a Shop Drawing or Sample, as submitted, indicates a variation from the Contract Requirements as set forth in the Contract Documents, Contractor shall identify the cost of the variation on the Shop Drawing or Sample. If the Engineer finds the variation to be in the interest of Contracting Agency and the variation involve no change in the Contract Price or time for performance, Engineer may approve the Shop Drawings or Samples.

1-06.1(5) Re-submittals

Contractor shall make corrections required by Engineer and shall return corrected copies in accordance with procedures described in Special Provision 1-06.1(3). Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

1-06.4 Handling and Storing Materials

Section 1-06.4 is supplemented with the following:
(Local Agency SP)

1-06.4(1) Pipe

Pipe and appurtenances shall be handled, stored, and installed as recommended by the manufacturer. Pipes with soft coatings such as coal tar enamel, paint, or the like shall be stored to protect the coating from physical damage or other deterioration and shall only be handled with padded, wide slings. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.

1-06.4(2) Equipment and Devices

All equipment shall be adequately and effectively protected against damage from moisture, dust, handling, or other causes during transport from manufacturer's premises to the site. Each item or package shall be clearly marked with the number unique to the specification reference covering the item.

Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or sub-assembled units where possible.

All equipment items and valves with an assigned equipment number in this Project Manual shall have affixed to them in a prominent location, a label or tag displaying the assigned equipment number. Equipment item and valves lacking a number shall have a similar tag providing a unique description of the item. Markers shall be of stainless steel or aluminum, affixed to the item with stainless steel fasteners, or as otherwise approved by the Engineer. Plastic labels will not be acceptable.

During the interval between delivery and installation, all equipment shall be stored in enclosed, weather-tight licensed commercial warehouses. Environmental controls such as heaters or protective encapsulation shall be provided to ensure against condensation and moisture damage. In the event prolonged (more than 90 days) storage is required for any item of rotative equipment, the Contractor shall institute a preventive maintenance program that shall include grease protection of bare metal surfaces, periodic indexing of rotating parts, renewal of grease in bearings, and any procedures recommended by the manufacturer. The Contractor shall maintain adequate records to demonstrate full compliance with these requirements. All equipment shall be available for inspection by the Engineer.

After installation, all equipment shall be protected from damage, including but not limited to moisture, dust, abrasive particles, debris, and dirt generated by the placement, chipping, sandblasting, cutting, finishing, and grinding of new or existing concrete, terrazzo, and metal; and the fumes, particulate matter, and splatter from welding, brazing, and painting of new and existing piping and equipment. The Contractor is advised that as a minimum, vacuum cleaning, blowers with filters, protective shielding, and other dust-suppression methods will be required at all times to adequately protect all equipment. During

concreting, including finishing, all equipment that may be affected by cement dust must be completely covered. During painting operations, all grease fittings and similar openings shall be covered to prevent the entry of paint. Electrical switch gear, unit substation, and motor load centers shall not be installed until all concrete work and sandblasting in those areas have been completed and accepted.

1-06.4(3) Delivery of Material or Equipment

The Contracting Agency's or Engineer's personnel or representatives of the Contracting Agency or Engineer will not accept materials or equipment deliveries for the Contractor.

1-06.6 Substitutions

Section 1-06.6 is added as the following:
(Local Agency SP)

Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review.

"Or Equal Items"

"Or Equal" Items: If, in Engineer's sole discretion, an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or equal" item, in which case review and acceptance of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for acceptance of proposed substitute items. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if; in the exercise of reasonable judgment Engineer determines:

1. The proposed item is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
2. The proposed item will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
3. Operation and maintenance costs and requirements are reasonably similar; and
4. The proposed item has a proven record of performance and comparable availability of service and parts.

Contractor shall also certify that, if approved and incorporated into the Work:

1. No increase in cost to the Contracting Agency or increase in Contract Times will result, and
2. The proposed item will conform to the detailed requirements of the item named in the Contract Documents.

If requested by the Engineer, Contractor shall furnish additional information for the Engineer's review and consideration. Insufficient or inadequate information to substantiate an "or equal" determination by the Engineer will be grounds for rejection.

Substitute Items

If, in Engineer's sole discretion, an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, it will be considered a proposed substitute item. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefore. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

The requirements for review by Engineer will be as set forth herein and as Engineer may decide is appropriate under the circumstances. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1. Shall certify that the proposed substitute item will:
    a. Perform adequately the functions and achieve the results called for by the general design,
    b. Be similar in substance to that specified, and
    c. Be suited to the same use as that specified;
2. Will state:
    a. The extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;
    b. Whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Contracting Agency for other work on the Project) to adapt the design to the proposed substitute item; and
    c. Whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
3. Will identify:
    a. All variations of the proposed substitute item from that specified;
    b. Available engineering, sales, maintenance, repair, and replacement services; and
    c. Schedule impacts and changes to the construction schedule
4. Shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change,

Contractor shall supply three (3) copies of data substantiating compliance of proposed product or supplier with Contract Documents on all requests for acceptance of change of any product or manufacturer. Each copy shall include:

1. Detailed description of the proposed change, including:
    a. Product identification, including manufacturer's name and address;
    b. Manufacturer's identification, including manufacturer's name and address;
    c. Samples of proposed products;
    d. Name, address, and telephone number of contact persons for similar projects on which product was used and date of installation; and
    e. Drawings indicating and vertical details of all architectural, structural, mechanical and electrical elements of proposed change.
2. Itemized comparison of proposed substitution with product or supplier specified;
3. Relation to separate subcontracts and trades;
4. Cost data on proposed substitution in comparison with product or supplier specified; and
5. Operation and maintenance requirements and costs;

Requests for change of product or design shall include certification by the Contractor that:

1. The Contractor has personally investigated the proposed product or design deviation and has determined that it is equal or superior in all respects to that specified;
2. The Contractor will provide the same guarantee for product or design deviation as for product or design specified; and
3. The Contractor will coordinate installation of accepted product or design deviation into work, making such changes as may be required for work to be complete in all respects.

Requests for change of products will not be considered if:

1. They are indicated or implied on project data submittals without a formal request having been submitted; and/or
2. Acceptance will require substantial revision to the Contract Documents.

Substitute Construction Methods or Procedures

If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those required for substitute items.

Engineer's Evaluation

Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made. Engineer may require Contractor to furnish additional data about the proposed substitute item, method or procedure. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by either a Change Order or an approved Shop Drawing. Engineer will advise Contractor in writing of any negative determination. The Engineer may elect to reject any or all requests for deviation at his sole discretion without cause or justification. The Contractor shall immediately proceed with the Work in accordance with the Contract Documents upon notification of rejection of any request for deviation.

Special Guarantee

Contracting Agency may require Contractor to furnish, at Contractor's expense, a special performance guarantee or other surety with respect to any substitute, change in construction methods or procedures, or change in design.

Engineer's Cost Reimbursement

Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute item so proposed or submitted by Contractor, the Contracting Agency may subtract said costs from payments due to the Contractor. The Contracting Agency may also subtract any charges of the Engineer associated with making changes in the Contract Documents (or in the provisions of any other direct contract with Contracting Agency) resulting from the acceptance of each proposed substitute.

Contractor's Expense

Contractor shall provide all data in support of any proposed substitute or "or equal" at Contractor's expense. The Contractor shall be responsible for and assume all costs of all elements involving implementing and completing approved deviations including, but not limited to, coordination, confirming dimensions at the job site, design, preparation of plans, procurement of materials and equipment, fabrication, construction, installation and instigation of service. If, in the opinion of the Engineer, the completed improvements of each deviation do not fulfill, provide and meet the defined and implied intent of the Contract Documents, the Contractor shall provide the labor, materials, and equipment required to modify the Work to the satisfaction of the Engineer.

The Contractor shall be responsible for modifications to electrical, structural, mechanical, or other aspects of the work or design as required to install or incorporate materials or equipment selected by the Contractor.

Regardless of the method of specification or selection, any product which is installed or incorporated into the work without prior acceptance of the Engineer may not be accepted by the Contracting Agency.

When material or equipment is specified by performance requirement or reference to specifications, standards, or publications of organizations, the Contractor shall select material or equipment which the Contractor considers to comply with the specified reference standard. The Contractor shall submit a request for acceptance of the selected product in accordance with these Special Provisions.

1-06.7 Testing and Quality Control

Section 1-06.7 is added as the following:
(Local Agency SP)

Contracting Agency-Furnished Testing and Inspections

The Contracting Agency will retain a qualified independent testing laboratory to perform the laboratory and field tests listed below:

1. Testing of backfill materials (e.g., sieve analysis, sand equivalent)
2. Moisture-density relationships of backfill materials
3. In-place soil density of trench backfill
4. In-place soil density of structure backfill
5. In-place soil density of paving sub-base and structural section, including asphalt concrete
6. Concrete slump and compressive strength on field placed cement concrete
7. Special inspections

The Contractor shall fully cooperate with Contracting Agency-Furnished Testing and Inspections. Contractor shall provide Contracting Agency's Representative timely notice on the readiness of work for required inspections, tests or acceptance. The Contractor shall provide access to the work for testing personnel. Where testing is to be performed in a potentially unsafe or confined work area, the Contractor shall stop work and provide all required safety measures to assure the safety of testing personnel.

The Contracting Agency will provide one copy of test results to the Contractor as soon as they are available. The Contractor shall anticipate that extensive laboratory and/or field testing will be performed by the laboratory retained by the Contracting Agency.

The Contractor shall anticipate that such testing may hinder, delay, or complicate execution of the work. The Contractor shall not be entitled to an extension of Contract Time or to any claim for damages because of hindrances, delays, or complications caused by or resulting from laboratory and/or field testing performed by the Contracting Agency.

Special inspection by certified inspectors and a certified testing lab may be required on the following, but not limited to:

1. Structural steel
2. Structure concrete reinforcement and concrete
3. Masonry
4. Structure excavation/fill
5. Anchor bolts

The Contractor shall coordinate with the Contracting Agency's Representative and fully cooperate with the testing services company for the above testing and special inspections and other testing and special inspections as may be specified elsewhere in the Special Provisions. The Contractor shall provide

access to the work for testing personnel. Where testing is to be performed in a potentially unsafe or confined work area, the Contractor shall stop work and provide all required safety measures to assure the safety of testing personnel. Contractor shall furnish Engineer copies of all agency inspection reports or approvals.

Correction of Defective Work

If test or operational results indicate that the work performed, or materials or equipment furnished, by the Contractor does not comply with the Contract Documents, the Contractor shall immediately take all necessary measures to correct the defective work, and/or replace defective materials or equipment. Depending on the situation, an independent testing firm may be retained to test the corrected work to determine if the corrections are satisfactory. All costs that are incurred by the Contracting Agency and Engineer as a result of the defective work, materials or equipment, including retesting, shall be borne by the Contractor and will be deducted from progress payments.

END OF SECTION 1-06

1-07 Legal Relations and Responsibilities to the Public

1-07.1 Laws to be Observed

Section 1-07.1 is supplemented with the following:
(October 1, 2005 APWA GSP)

In cases of conflict between different safety regulations, the more stringent regulation shall apply.

The Washington State Department of Labor and Industries shall be the sole and paramount administrative agency responsible for the administration of the provisions of the Washington DOSH.

The Contractor shall maintain at the project site office, or other well-known place at the project site, all articles necessary for providing first aid to the injured. The Contractor shall establish, publish, and make known to all employees, procedures for ensuring immediate removal to a hospital, or doctor's care, persons, including employees, who may have been injured on the project site. Employees should not be permitted to work on the project site before the Contractor has established and made known procedures for removal of injured persons to a hospital or a doctor's care.

The Contractor shall have sole responsibility for the safety, efficiency, and adequacy of the Contractor's plant, appliances, and methods, and for any damage or injury resulting from their failure, or improper maintenance, use, or operation. The Contractor shall be solely and completely responsible for the conditions of the project site, including safety for all persons and property in the performance of the work. This requirement shall apply continuously, and not be limited to normal working hours. The required or implied duty of the Engineer to conduct construction review of the Contractor's performance does not, and shall not, be intended to include review and adequacy of the Contractor's safety measures in, on, or near the project site.

Section 1-07.1 is further supplemented with the following:
(Local Agency SP)

The Contractor shall be responsible to immediately report to the Engineer any deviation from the contract provisions pertaining to environmental compliance, including but not limited to spills, unauthorized fill in waters of the State, including wetlands, water quality standards, noise, air quality, etc.

COVID-19 Health and Safety Plan (CHSP)

In response to COVID-19, the Contractor shall prepare a project specific COVID-19 health and safety plan (CHSP) in conformance with Section 1-04.3(11) of these special provisions. A copy of the CHSP developed by the Contractor shall be submitted to the Engineer as a Type 2 Working Drawing.

1-07.2 State Taxes

Section 1-07.2 is deleted, including its sub-sections, and replaced with the following:
(June 27, 2011 APWA GSP):

1-07.2 State Sales Tax

The Washington State Department of Revenue has issued special rules on the State sales tax. Sections 1-07.2(1) through 1-07.2(4) are meant to clarify those rules. The Contractor should contact the Washington State Department of Revenue for answers to questions in this area. The Contracting Agency will not adjust its payment if the Contractor bases a bid on a misunderstood tax liability.

The Contractor shall include all Contractor-paid taxes in the unit bid prices or other contract amounts. In some cases, however, state retail sales tax will not be included. Section 1-07.2(2) describes this exception.

The Contracting Agency will pay the retained percentage (or release the Contract Bond if a FHWA-funded Project) only if the Contractor has obtained from the Washington State Department of Revenue a certificate showing that all contract-related taxes have been paid (RCW 60.28.051). The Contracting Agency may deduct from its payments to the Contractor any amount the Contractor may owe the Washington State Department of Revenue, whether the amount owed relates to this contract or not. Any amount so deducted will be paid into the proper State fund.

1-07.2(1) State Sales Tax – Rule 171

WAC 458-20-171, and its related rules, apply to building, repairing, or improving streets, roads, etc., which are owned by a municipal corporation, or political subdivision of the state, or by the United States, and which are used primarily for foot or vehicular traffic. This includes storm or combined sewer systems within and included as a part of the street or road drainage system and power lines when such are part of the roadway lighting system. For work performed in such cases, the Contractor shall include Washington State Retail Sales Taxes in the various unit bid item prices, or other contract amounts, including those that the Contractor pays on the purchase of the materials, equipment, or supplies used or consumed in doing the work.

1-07.2(2) State Sales Tax – Rule 170

WAC 458-20-170 and its related rules apply to the constructing and repairing of new or existing buildings, or other structures, upon real property. This includes, but is not limited to, the construction of streets, roads, highways, etc., owned by the state of Washington; water mains and their appurtenances; sanitary sewers and sewage disposal systems unless such sewers and disposal systems are within, and a part of, a street or road drainage system; telephone, telegraph, electrical power distribution lines, or other conduits or lines in or above streets or roads, unless such power lines become a part of a street or road lighting system; and installing or attaching of any article of tangible personal property in or to real property, whether or not such personal property becomes a part of the realty by virtue of installation.

For work performed in such cases, the Contractor shall collect from the Contracting Agency, retail sales tax on the full contract price. The Contracting Agency will automatically add this sales tax to each payment to the Contractor. For this reason, the Contractor shall not include the retail sales tax in the unit bid item prices, or in any other contract amount subject to Rule 170, with the following exception.

Exception: The Contracting Agency will not add in sales tax for a payment the Contractor or a subcontractor makes on the purchase or rental of tools, machinery, equipment, or consumable supplies not integrated into the project. Such sales taxes shall be included in the unit bid item prices or in any other contract amount.

1-07.2(3) Services

The Contractor shall not collect retail sales tax from the Contracting Agency on any contract wholly for professional or other services (as defined in Washington State Department of Revenue Rules 138 and 244).

1-07.5(3) State Department of Ecology

Section 1-07.5(3) is supplemented with the following:
(Local Agency SP)

The Contractor shall provide for safe access to the construction site and to the Contractor's records by the Washington State Department of Ecology personnel.

1-07.5(5) Noise Restrictions

Section 1-07.5(5) is added as the following:
(Local Agency SP)

The Contractor shall comply with all local controls and noise level rules, specified requirements, regulations and ordinances which apply to any work performed pursuant to the Contract. If the requirements of this Section are more restrictive than those of the local regulations or specified in Section 02 22 29, the requirements of this Section shall govern.*

Each internal combustion engine, used for any purpose on the job or related to the job, shall be enclosed and be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without said muffler and enclosure.

Noise levels for scrapers, pavers, graders and trucks shall not exceed 90 dBA and pile drivers shall not exceed 95 dBA at 50 feet as measured under the noisiest operating conditions. For all other equipment, noise levels shall not exceed 85 dBA. Equipment that cannot meet these levels shall be quieted by the

use of improved exhaust mufflers, portable acoustical screens, or other means. Equipment not modified to meet these requirements shall be removed from the project.

Where feasible, the Contractor shall use electric rather than diesel or gas-powered equipment.

1-07.6 Permits and Licenses

Section 1-07.6 is deleted and replaced with the following:
(Local Agency SP)

1-07.6(1) Contracting Agency-Furnished Permits

The Contracting Agency is responsible for obtaining the following permits:

1. Site Development Activity Permit (SDAP).
2. Building Permit (to be issued after award of project).
3. ~~Department of Ecology Stormwater General Permit~~*

Copies of these Contracting Agency-Furnished permits are included in Appendix F.

The Contractor shall comply with all conditions and requirements of the Contracting Agency-Furnished Permits. The Contractor shall provide access to the project by regulatory officials for determination of compliance. The Contractor shall anticipate that compliance with the permits and any necessary corrective action may result in delay or hindrance of the Contractor's prosecution of the work. The Contractor shall not be entitled to any additional compensation or extension of Contract Time for delays or additional work resulting from compliance with Contracting Agency-Furnished Permits.

1-07.6(2) Contractor-Furnished Permits

The Contractor shall apply for, and pay all costs associated with all other required permits not listed as Contracting Agency-Furnished Permits in Section 1-07.6(1) above. Failure of the Contractor to identify and obtain all required permits shall not relieve the Contractor of the responsibility of compliance with all applicable regulatory requirements.

The Contractor shall comply with all conditions and requirements of the Contractor-Furnished Permits. The Contractor shall provide safe access to the project by regulatory officials for determination of compliance. The Contractor shall anticipate that compliance with the permits and any necessary corrective action may result in delay or hindrance of the Contractor's prosecution of the work. The Contractor shall not be entitled to any additional compensation or extension of Contract Time for delays or additional work resulting from compliance with Contractor-Furnished Permits.

The Contractor shall furnish all bonds and insurance required by the controlling agencies, and shall, if requested, pay for any inspection and testing.

The Contractor shall furnish the Engineer with one copy of each permit issued for borrow, fill, or waste material required for or generated by the contract work. The Contractor shall notify the Engineer in writing of the location of all borrow, fill, and waste sites regardless of whether a permit is required.

All costs incurred by the Contractor in procuring permits and complying with stipulations in the permits and approvals shall be incidental to and included in the various items of work in the project; and no additional compensation will be made.

Anticipated Contractor-Furnished Permits include:

1. State of Washington Department of Ecology Construction Stormwater General Permit – ~~Contracting Agency will apply for the Notice of Intent (NOI). Once received, the NOI will be transferred to the Contractor and the*~~ Contractor will be responsible for <u>applying for coverage and conducting</u>* all associated monitoring and compliance measures. <u>A copy of a SEPA exemption letter from Kitsap County's Department of Community Development is added as part of this addendum to assist in the application process.</u>*
2. Encroachment/ROW/Roadway Permit.

3. Demolition Permit.

4. Electrical Permit.

A draft Storm Water Pollution Prevention Plan (SWPPP) has been included in Appendix C. Contractor may modify this SWPPP to address the Contractor's means and methods or prepare a new SWPPP as required by the Construction Stormwater General Permit.

1-07.6(3) Business and Contracting Licenses

At a minimum, the Contractor and his subcontractors shall have the following licenses and shall submit proof of such licensing to the Contracting Agency upon request:

1. Washington State Business License

2. Washington State Contractor License

1-07.9(1) General

Section 1-07.9(1) is supplemented with the following:
(Local Agency SP)

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 his 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.

1-07.13(1) General

Section1-07.13(1) is supplemented with the following:
(Local Agency SP)

The Contracting Agency reserves the right to use and/or occupy any portion of the project or it's improvements which have been completed sufficiently to permit use and occupancy and such use shall not be construed as an acceptance of the work or any part thereof, and any claims which the Contracting Agency may have against the Contractor shall not be deemed to have been waived by such use and/or occupancy.

1-07.14 Responsibility for Damage

Section 1-07.14 is supplemented with the following:
(Local Agency SP)

The Contractor shall protect, defend, indemnify, and save harmless the Contracting Agency, its officers, officials, employees, agents, and Engineer 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 Engineer 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 Engineer 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.

1-07.15 Temporary Water Pollution/Erosion Control

Section 1-07.15 is supplemented with the following:
(Local Agency SP)

The Contractor shall submit bi-weekly updates of the temporary water pollution/erosion control plan. These updates shall include, but are not limited to, sketches showing location of control facilities such as straw bales, silt fences, and areas to be covered at end of shift. These updates shall be submitted to the Engineer for review every other week unless otherwise directed by the Engineer. The Engineer will review the updated plan and provide comments to Contractor.

The Contractor shall be responsible throughout the life of the project to take all necessary precautions to prevent pollution, erosion, siltation, and related damage to property caused by any water leaving work areas, including borrow and stockpile areas. All silt shall be contained within the construction area. Required temporary water pollution control measures shall be in accordance with the requirements of Section 31 25 14.

The Contractor shall pay all fines and citations charged to the Contracting Agency for discharging turbid water from the site during the life of the project. In addition, the Contractor shall pay all costs for repair to property damaged (onsite and offsite) by water discharged from work areas used in this Contract.

Construction and maintenance of erosion control measures shall be performed according to the Contract Documents and applicable permits. Other or additional temporary water pollution/erosion control measures may be required at the discretion of the Engineer. Costs for temporary water pollution/erosion control shall be in accordance with that specified in Section 8-01 as amended in the Special Provisions.

The Contractor shall meet all federal, state and local pollution control regulations for all work performed under this contract. No lime, wet concrete, petroleum products, silts, organic material or other deleterious materials are allowed to fall, flow, leach, or otherwise enter public waters.

The Contractor shall observe all statutes, ordinances and regulations pertaining to the prevention of environmental pollution and the preservation of public natural resources. All such statutes, ordinances, regulations or portions thereof pertaining to work under this contract are hereby incorporated with and made part of this contract.

The Contractor shall be aware of these provisions and coordinate with the specific controlling agencies.

The Contractor shall furnish all bonds and insurance required by the controlling agencies and shall, if requested, pay for any inspections and testing accomplished or furnished by them.

1-07.15(1) Spill Prevention, Control and Countermeasures Plan

Section 1-07.15(1) is supplemented and modified as follows:
(Local Agency SP)

All costs associated with this work shall be considered incidental to the construction and included in other items of work.

1-07.16(1) Private/Public Property

Section 1-07.16(1) is supplemented with the following:
(Local Agency SP)

The Contractor shall restore all roads and streets in which the surface is removed, broken or damaged, or in which the ground has caved or settled, due to hauling of materials, equipment and/or supplies and installation of the improvements covered by this contract, to the original grade and crown section unless otherwise indicated. Contractor shall match the existing surfacing for depth, materials and surface finish, including striping and pavement markings, except as otherwise specified.

At all times during work, the Contractor shall keep the premises clean and orderly, and upon completion of the work, repair all damage caused by equipment and leave the project free from all rubbish and excess material of any kind.

The Contractor shall reconstruct all curbs, driveways, sidewalks and similar structures and utilities, which are broken or damaged during construction. Reconstruct with the same kind of material with the same finish, and in not less than the same dimensions as the original work. Remove and replace the entire portions between joints or scores and not merely by refinishing the damaged part. Match the appearance of the existing improvements as nearly as possible.

The Contractor shall be fully responsible for the prevention of damage to the City's, County's or State's roads. Prior to beginning construction, the Contractor shall obtain any and all licenses or permits required for the travel on, and work within, the Road Right-of-Way.

Paved areas including adjacent or haul route streets shall be maintained for the duration of the Contract. Street sweeping shall be performed as required and at the direction of the Engineer using a self-propelled vehicle outfitted with rotating brushes and a filtered vacuum system to collect sediment, dust, and debris from paved road surfaces. The vehicle shall store street sweepings internally. Collected street sweepings shall be disposed of by approved disposal method(s) in accordance with the Contract. The Contractor shall provide a wheel wash, if necessary, to prevent tracking of mud and dirt onto paved roads. Wheel wash water shall not be discharged to any storm drain or stream. Thoroughly clean all

spilled dirt, gravel, or other material caused by the construction activities from all roads and streets at the end of each day.

The Contractor shall at all times maintain the integrity of the existing pavement, shoulder, culverts, and roadside ditches. If the existing pavement or shoulder is removed, broken, or damaged as a result of the construction of the improvements covered by this Contract, the Contractor shall restore the damaged area to the original grade and crown sections in accordance with the Standard Specifications. New surfacing shall match the existing surfacing for depth, materials and surface finish, including striping and pavement markings. Restore all culverts equal to existing condition or better.

Vehicles leaving the site shall be cleaned and loads secured to prevent the deposition of muds, silts, sands and construction materials on roads or highways. Any such degradation of roads or highways shall be corrected by the end of each working day so that the road is in a clean state. Tracked vehicles shall be constrained to paved or unpaved areas that will be restored.

1-07.16(2) Vegetation Protection and Restoration

Section 1-07.16(2) is supplemented with the following:
(Local Agency SP)

Restore all areas that are disturbed or damaged by actions of the Contractor to their original condition. Remove ornamental trees and shrubbery with earth surrounding the roots wrapped in burlap, and replant in their original positions, or, as an alternative, replace with equal material.

For lawn areas, cut sod, roll and replace after the excavation has been properly compacted or, as an alternative, cover the excavated area with top soil to the depth of the original top soil and reseed, water and maintain as directed.

The materials storage areas shall be re-graded and seeded at the conclusion of the project. Any damage to fences, walks, curbs, driveways, etc. shall be handled in accordance with the applicable sections of these specifications.

The Contractor shall obtain a signed release from all property owners whose property is impacted by the construction stating that the restoration has been done to the property owner's satisfaction. If the Contractor cannot obtain such a release, and the restoration has been done to what should be acceptable, the Contractor shall notify the Engineer and explain why a signed release cannot be obtained. Engineer shall then judge whether Contractor may be released from this requirement for that property.

1-07.16(4)A Inadvertent Discovery of Human Skeletal Remains

The first paragraph of Section 1-07.16(4)A is revised to read as follows:
(Local Agency SP)

If human skeletal remains are encountered by the Contractor, they shall not be further disturbed. The Contractor shall immediately notify the Engineer of any such finds, and shall cease all work in the area of, and adjacent to, the discovery, in an area adequate to provide for the total security and protection of the integrity of the skeletal remains. In accordance with RCW 27.44.055 (Duty to Notify section of Indian Graves and Records Act), the Engineer will notify the Contracting Agency who will then be responsible for making the necessary notifications and ensuring that the appropriate actions are taken to secure and protect the discovery site and remains. The Engineer or Contracting Agency may require the Contractor to suspend work in the vicinity of the discovery until final determinations are made and removal of the skeletal remains is completed.

1-07.16(6) Interfering Structures

Section 1-07.16(6) is added as the following:
(Local Agency SP)

The Contractor shall take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Drawings. The completeness and accuracy of information shown however, cannot be guaranteed. Protect underground and aboveground existing structures from damage, whether or not they lie within the

limits of the easements obtained by the Contracting Agency. Where such existing fences, gates, barns, sheds, buildings, or any other structure must be removed in order to properly carry out the construction, or are damaged during construction, restore to their original condition to the satisfaction of the property owner involved at the Contractor's own expense. Notify the Engineer of any damaged underground structure, and make repairs or replacements before backfilling.

If existing structures are encountered which prevent the construction, and which are not properly shown on the Drawings, notify the Engineer before continuing with the construction in order that the Engineer may make such field revisions as necessary to avoid conflict with the existing structures. It is expected that minor relocations of the work will be necessary during the progress of construction. If the Contractor fails to notify the Engineer when an existing structure is encountered, and proceeds with construction despite this interference, the Contractor shall do so at the Contractor's own risk and expense.

1-07.17 Utilities and Similar Facilities

Section 1-07.17 is supplemented with the following:
(Local Agency SP)

The information shown or indicated in the Contract Documents with respect to existing underground facilities at or contiguous to the site is based on available information furnished to the Contracting Agency or Engineer by the owners of such Underground Facilities without necessarily uncovering, measuring or other verification of the utilities. The depth of existing utilities, if indicated, may only be an approximation. Additional utilities may be encountered and the actual locations of the utilities indicated on the Plans may vary from the locations indicated. The information is provided for the convenience of the Contractor only, and no responsibility is assumed by either the Contracting Agency or the Engineer for its accuracy or completeness. The Contractor shall have full responsibility for reviewing and checking utility information, locating all underground facilities, and coordinating work with the owners of such underground facilities. The Contractor shall take the necessary precautionary measures to protect the existing utilities and structures indicated and any other utilities or structures which may be encountered during construction and shall be responsible for the repair of any damage thereto resulting from the work if:

1. The utility owner has field located and marked its facilities and the actual location of any portion of the utility is within two feet horizontally either side of said location mark; or
2. The utility system is visible or has become visible or can be reasonably assumed to exist at the location due to visible evidence prior to the damage; or
3. The Contractor failed to provide the required notification to the utility owner prior to the damage to the utility; or
4. The actual depth is different by more than one (1) foot from than that indicated on the Plans.

Existing underground utilities, whether public or private, which are damaged by the Contractor, will be repaired by the utility owner or as directed by the utility owner.

All existing utilities shall be maintained in continuous operation and properly protected during the Contractor's operations, unless the Contractor receives written approval from the utility owner for interruption of service. In addition, all work by the Contractor adjacent to, or in the vicinity of, existing utilities shall be performed in accordance with the requirements of the utility owners. The Contractor shall pay all permit, inspection, and other fees levied by the utility owners. Where the Contractor's operations could damage or inconvenience other utility systems or services, the operations shall be suspended until all arrangements necessary for the protection or relocation of these utilities and services have been made by the Contractor. Notify all utility offices, which are affected by the construction operation at least 48 hours in advance. Under no circumstances expose any utility without first obtaining permission from the appropriate agency. Once permission has been granted, locate, expose, and provide temporary support for all existing underground utilities.

The Contractor shall anticipate that service lines between utility systems and private residences will be encountered and no additional compensation shall be made with work associated with crossings of any service lines. Service lines may not be shown on the Plans and may not be field located by the utility.

The Contractor shall determine the actual location and protect from damage all service lines. If any utilities or service lines are damaged by the construction operations, Contractor shall promptly notify the proper authority and begin or cause the repair as required by the utility so that the utility or service is back in service as promptly as possible. In no case shall interruption of any water, sewer, or other utility service be allowed to exist outside working hours unless prior approval is granted.

In the event the Contractor encounters water service lines that interfere with trenching, the Contractor may, by obtaining prior approval of the property owner, Water Department and the Engineer, cut the service, dig through, and restore the service with similar and equal materials at the Contractor's sole expense. In the event the Contractor encounters water service lines that interfere with new improvements, the Contractor shall notify the Engineer.

Some existing utility poles, lines, piping and/or appurtenances may need to be held in place, removed or relocated as part of this project. If said work is required, the Contractor shall coordinate and schedule all such work with the respective utilities so that the Contractor's work and schedule are not impacted. Public and private utilities, or their contractors, will furnish all work necessary to hold, adjust, relocate, replace, or construct their facilities unless otherwise provided for in the Plans or these Special Provisions. Such work, if required, will be done during the prosecution of the work for this project. The Contractor's attention is directed to the fact that significant lead times may potentially be required to coordinate and schedule with the utility companies to perform the work.

Removal, relocation, and adjustment of existing utilities where shown on the Plans or where it could reasonably be foreseen to accommodate the work by the Contractor shall be ordered and paid for by the Contractor. If or when utility conflicts occur, the Contractor shall continue construction on other aspects of the project. Any change to the operation necessary to work around the conflicts shall be incidental to the various bid items of the contract and no further compensation will be made.

The Contractor shall anticipate that the owners of existing utilities may choose to modify and/or improve the existing systems at the time that the Contractor is working. The Contractor shall perform any and all work required to accommodate concurrent work by the owners of existing utilities. The Contractor shall coordinate his activities with those of the utility owners to enable both activities to proceed without delay.

The Contractor shall call the Utilities Underground Locate Center (One Call Center) for field location of utilities not less than two or more than ten business days before the scheduled date for commencement of excavation which may affect underground utility facilities. Notice shall be provided individually to those owners who are not members of the one-number locator service and are known to or suspected of having underground facilities within the area of proposed excavation. The Washington State Department of Transportation is not a participant in the One Call Center and shall be contracted directly for any work that may impact utilities in the State right of way.

The Contractor shall anticipate that work may be hindered or delayed by:

1. The removal, relocation and adjustment of any utility;
2. Maintenance operations of existing utility systems; or
3. The requirements of the owners of existing utility systems.

The Contractor shall not be entitled to an extension of time or to any claim for damages because of hindrances or delays caused by these activities.

The following addresses and telephone numbers of utility companies known or suspected of having facilities within the project limits and other pertinent contacts are supplied for the Contractor's convenience:

Kitsap County Public Works 614 Division Street Port Orchard, WA 98366 (360) 337-5631 Floyd Bayless	(Pump Station 19) Silverdale Water District 5300 NW Newberrry Hill Road, Suite #100 Silverdale, WA 98383 (360) 447-3513 Mike Pleasants	(Pump Station 31) North Perry Water District 2921 Perry Avenue Bremerton, WA 98310 (360) 373-9508 George Smalley
(Pump Station 19) Puget Sound Energy 6522 Kitsap Way Bremerton, WA 98312 (360) 204-0473 Susan Williams	(Pump Station 31) Puget Sound Energy 6522 Kitsap Way Bremerton, WA 98312 (425) 365-6940 Ryan Fish	Kitsap Transit 60 Washington Avenue, Suite 200 Bremerton, WA 98337 (360) 479-6966 Kathryn Jordan
Cascade Natural Gas 6313 Kitsap Way Bremerton, WA 98312 (360) 373-1405 Rick Coy or Chris Bassard	Paratransit Services 4810 Auto Center Way, Ste Z Bremerton, WA 98132 (800) 933-3468 Colleen Clark	Comcast 1225 Sylvan Way Bremerton, WA 98310 (360) 377-8528, Office (877) 824-2288, Service (800) 424-5555, Buried Cable Location
Qwest/Century Link (360) 478-5930 Roy Klein or Dan O'Tool		

1-07.18 Public Liability and Property Damage Insurance

Section 1-07.18 is deleted and replaced with the following:
(Local Agency SP):

1-07.18 Insurance

1-07.18(1) General Requirements

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-: VII 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 (5) 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.

1-07.18(2) Additional Insured

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

1. The Contracting Agency and its officers, elected officials, employees, agents, and volunteers;
2. The Contracting Agency's consultant, BHC Consultants, LLC and its subconsultants;
    a. Landau Associates, Inc.
    b. AES Consultants, Inc.
    c. FSi Consulting Engineers
3. The Contracting Agency's construction observation 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 pursuant to 1-07.18(3) 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 listed entities.

1-07.18(3) 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.

1-07.18(4) 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 Section 1-07.18(2) 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.

1-07.18(5) Coverages and Limits

The insurance shall provide the minimum coverages and limits set forth below. Providing coverage in these stated minimum limits shall not be construed to relieve the Contractor from liability in excess of such limits. All deductibles and self-insured retentions must be disclosed and are subject to approval by the Contracting Agency. The cost of any claim payments falling within the deductible shall be the responsibility of the Contractor.

1-07.18(5)A 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 a period of 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.

1-07.18(5)B 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

1-07.18(5)C 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.

If work is to be performed on or near any navigatable waterway, the Contractor shall be responsible for determining if United States Longshore and Harbor Workers Insurance is applicable for this project and shall be responsible for procuring such if the insurance is determined to be applicable. At no time shall the Contracting Agency or the Engineer be responsible for making this determination.

1-07.18(5)D Builder's 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 engineer'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: $5,000,000

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.

1-07.18(5)E 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 excess over and as least as broad in coverage as the Contractor's Commercial General and Auto Liability insurance.

All entities listed under 1-07.18(2) of these Special 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.

1-07.18(5)F 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 under 1-07.18(2) of these Special Provisions 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:

$1,000,000 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).

1-07.18(5)G Professional Liability

The Contractor and/or its Subcontractors and/or its design consultant providing construction management, value engineering, or any other design-related non-construction professional services shall provide evidence of Professional Liability insurance covering professional errors and omissions. Such policy must provide the following minimum limits:

$1,000,000 per claim and annual aggregate

If the scope of such design-related professional services includes work related to pollution conditions, the Professional Liability insurance shall include coverage for Environmental Professional Liability.

If this 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.

1-07.18(5)H LHWCA Insurance

If this Contract involves work on or adjacent to Navigable Waters of the United States, the Contractor shall procure and maintain insurance coverage in compliance with the statutory requirements of the U.S. Longshore and Harbor Workers' Compensation Act (LHWCA).

Such policy must provide the following minimum limits:

$1,000,000 Bodily Injury by Accident – each accident

$1,000,000 Bodily Injury by Disease – each employee

$1,000,000 Bodily Injury by Disease – policy limits

1-07.18(5)I Protection & Indemnity Insurance Including Jones Act

If this Contract involves marine activities, or work from a boat, vessel, or floating platform, the Contractor shall procure and maintain Protection and Indemnity (P&I) coverage including collision liability, injury to crew (Merchant Marine Act of 1920 - Jones Act) and passengers, removal of wreck and liability for seepage, pollution, containment and cleanup using form SP-23 or SP 38 or a form as least as broad.

All entities listed under 1-07.18(2) of these Special Provisions shall be named as additional insureds on the Contractor's Protection and Indemnity insurance policy.

Such policy must provide the following minimum limits:

$1,000,000 Bodily Injury by Accident – each accident or occurrence

$1,000,000 Bodily Injury by Disease – each employee

$1,000,000 Bodily Injury by Disease – policy limits

1-07.18(5)J Hull and Machinery

If this Contract involves use of a boat, vessel, or floating platform, the Contractor shall procure and maintain coverage at Market Value of vessel on American Institute Hull Clauses, 6/2/77 form.

1-07.18(5)K Marine Pollution

The Contractor shall procure and maintain Pollution Liability (OPA, CERCLA) insurance to satisfy U.S. Coast Guard requirements as respects the Federal Oil Pollution Act of 1990 and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended.

Such policy must provide the following minimum limits, or statutory limits of liability as applicable, whichever is higher:

$1,000,000 per Occurrence

1-07.23 Public Convenience and Safety

Section 1-07.23 is supplemented with the following:
(Local Agency SP)

The Contractor shall be responsible to notify, in writing, local fire, school (South Kitsap School District), law enforcement authorities, Kitsap Transit, Paratransit Services, or other affected persons, not less than ten (10) working days prior to construction operations that will deviate and/or delay traffic from the existing traffic pattern, so that these agencies may reroute emergency or other vehicles and may revise bus stops as necessary.

The Contractor shall at all times conduct the work as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property. No road or street shall be closed to the public except with the permission of the Engineer and proper governmental authority. Contractor shall be aware that any road closures that last more than 12 hours will require approval by the County Commissioners prior to the closure. Obtaining that approval can take up to 8 weeks.

Fire hydrants on or adjacent to the work shall be kept accessible to firefighting equipment at all times. Temporary provisions shall be made by the Contractor to insure the use of sidewalks and private and public driveways, and the proper functioning of all gutters, sewer inlets, drainage ditches and culverts, irrigation ditches and natural water courses. Access must be maintained for foot and bus traffic to nearby schools.

The Contracting Agency and controlling public authorities shall be notified at least 24 hours in advance of any actions by the Contractor which may affect the functions of the police or fire departments, school system, or water and sewer districts.

The Contractor shall conduct the work and take preventative measures such that dust in the project area shall not become objectionable to the adjacent property owners. Should the Contracting Agency determine the Contractor is not fulfilling this obligation; the Contracting Agency reserves the right to take such action as may be necessary and to charge the Contractor for any costs that may be incurred in such remedial action.

All work shall be conducted with due regard for the safety of the public. Open trenches shall be completely backfilled or covered prior to the stop of work each day and provided with barricades of a type that can be seen at a reasonable distance, and at night they shall be distinctly indicated by adequately placed lights. Safety instructions received from the Engineer, Controlling Agency, or the Contracting Agency shall be observed, but the following of such instructions shall in no way relieve the Contractor of his responsibility or liability should any accident or loss occur as the result of the construction operations. Flaggers shall be provided by the Contractor as required to direct traffic.

It shall be the Contractor's responsibility to see that all requirements of the Federal William-Stieger Occupational Safety and Health Act as well as the State of Washington Industrial Safety and Health Act, are observed and enforced to protect all the workmen on the project as well as the general public.

Complaints received by the Contracting Agency concerning public inconvenience or safety hazards will be referred to the Contractor for immediate corrective action. In addition to normal work hours, corrective actions may need to be taken on Saturdays, Sundays, holidays, and at times other than normal work hours.

1-07.23(1) Construction under Traffic

The second paragraph of Section 1-07.23(1) is revised to read as follows:
(Local Agency SP)

To disrupt public traffic as little as possible, the Contractor shall permit traffic to pass through the work with the least possible inconvenience or delay. The Contractor shall maintain existing roads, streets, sidewalks, and paths within the project limits, keeping them open, and in good, clean, safe condition at all times. If there is need to temporarily block access, such blockages shall be coordinated with the Contracting Agency, the affected property owners, and the Engineer. Deficiencies caused by the Contractor's operations shall be repaired at the Contractor's expense. Deficiencies not caused by the

Contractor's operations shall be repaired by the Contractor when directed by the Engineer, at the Contracting Agency's expense. The Contractor shall also maintain roads, streets, sidewalks, and paths adjacent to the project limits when affected by the Contractor's operations. Snow and ice control will be performed by the Contracting Agency on all projects. Cleanup of snow and ice control debris will be at the Contracting Agency's expense. The Contractor shall perform the following:

1. Remove or repair any condition resulting from the work that might impede traffic or create a hazard.
2. Keep existing traffic signal and highway lighting systems in operation as the work proceeds. The Contracting Agency will remain responsible for the routine maintenance on such systems.
3. Maintain the striping on the roadway. The Contractor shall be responsible for scheduling when to renew striping, subject to the approval of the Engineer. When the scope of the project does not require work on the roadway, the Contracting Agency will be responsible for maintaining the striping.
4. Maintain existing permanent signing. Repair of signs will be at the Contracting Agency's expense, except those damaged due to the Contractor's operations.
5. Keep drainage structures clean to allow for free flow of water. Cleaning of existing drainage structures will be at the Contracting Agency's expense except when flow is impaired due to the Contractor's operations. Contractor shall be responsible for cleaning existing drainage structures that have been impaired by the Contractor's work.
6. All trenches within the right of way shall be backfilled completely and the surface restored to a good, clean, safe and drivable condition before leaving the site after each day's work. The Contractor may leave the trench open if steel sheets coated with asphalt are installed and properly wedged with cold mix to provide a smooth transition.

Contractor shall maintain pedestrian and vehicular traffic around the work areas at all times. ~~The Contractor shall also maintain ingress and egress to local businesses at all times.~~* The Contractor shall submit a traffic control plan for review and acceptance prior to construction. The traffic control plan shall clearly show the type, location and spacing of all traffic control devices. The Contractor shall maintain detour and warning signage ~~signing and changeable message signs (CMS) for the approved detour~~* throughout the duration of work ~~on Colchester Drive E/SE and/or on Yukon Harbor Road SE~~.* The traffic control plan shall be updated as needed as work progresses. The Contractor shall be held liable for all claims resulting from the improper installation and/or maintenance of ~~the~~* detour and traffic control plans.

1-07.24 Rights of Way

Section 1-07.24 is supplemented with the following:
(Local Agency SP)

Street right of way lines, limits of easements, and limits of construction permits are indicated on the Plans. The Contractor's construction activities shall be confined within these limits unless arrangements for use of private property are made by Contractor.

Generally, the Contracting Agency has obtained, prior to bid opening, all rights of way and easements, both permanent and temporary, necessary for carrying out the work. Exceptions to this are noted herein or will be brought to the Contractor's attention by a duly issued Addendum.

Whenever any of the work is accomplished on or through property other than public right of way, the Contractor shall meet and fulfill all covenants and stipulations of any easement agreement obtained by the Contracting Agency from the owner of the private property. Copies of the easement agreements may be obtained from the Contracting Agency. The following table summarizes the easements that have been acquired and any special conditions. This information is provided for convenience, and the Contractor shall be aware of, and comply with all special conditions contained in the easement documents whether they are listed in this table or not.

Owner	Parcel No.	Special Conditions
Temporary Construction Easements		
Sheldon Feldman	4926-000-053	Property owner shall retain ownership of the maple trees that are designated for removal. Contractor shall limb and cold stack these trees at a location on the property designated by the property owner or the County Construction Manager. Temporary and permanent easement is being acquired. Copies will of the documents and any pertinent conditions will be added to the contract once the easements are obtained.

Property owner(s) shall be given 2 working days' notice prior to entry by the Contractor. This includes entry onto easements and private property where private improvements must be adjusted.

The Contractor shall be responsible for providing, without expense or liability to the Contracting Agency, any additional land and access thereto that the Contractor may desire for temporary construction facilities, storage of materials, treatment/disposal of dewatering water, or other Contractor needs. However, before using any private property, whether adjoining the work or not, the Contractor shall file with the Engineer a written permission of the private property owner, and, upon vacating the premises, a written release from the property owner of each property disturbed or otherwise interfered with by reasons of construction pursued under this contract. The statement shall be signed by the private property owner, or proper authority acting for the owner of the private property affected, stating that permission has been granted to use the property and all necessary permits have been obtained or, in the case of a release, that the restoration of the property has been satisfactorily accomplished. The statement shall include the parcel number, address, and date of signature. Written releases must be filed with the Engineer before the Final Completion Date will be established.

1-07.28 Haul Route Restrictions

Section 1-07.28 is added as the following:
(Local Agency SP)

The Contractor shall contact all governing control agencies who have jurisdiction over proposed routes that will be used for the delivery and removal of materials for the project prior to bid. The Contractor shall follow the requirement(s) of the controlling agency and shall include the cost of complying with any such requirements in the applicable unit price per or lump sum bid item. No separate or additional payment will be made for regulatory agencies request for vehicle routing.

The Contractor shall submit a traffic control plan to all appropriate controlling agencies for hauling of import materials and excavation materials. The Contractor shall amend and abide by comments on the approved traffic control plan.

All roads shall be open to vehicular traffic after the completion of each day's construction activity. Steel plates, temporary fill, barricades and other measures shall be used to make disturbed roads safe and passable. Road closures (if allowed) shall be posted at least one week prior to the start of construction.

END OF SECTION 1-07

1-08 Prosecution and Progress

1-08.0 Preliminary Matters

Section 1-08.0 and its subsections are added as the following:
(Local Agency SP)

1-08.0(1) Preconstruction Public Meeting

Prior to the Contractor beginning work, the Contracting Agency will hold a public meeting for property owners that will or may be affected by the project. Contracting Agency representatives, the Engineer, and the Contractor (project manager and superintendent) will attend this preconstruction public meeting. The purpose of this meeting is to introduce the project team; discuss the project; listen to, and address the public's concerns; and obtain input and answer the public's questions,

1-08.0(2) Preconstruction Conference

Prior to the Contractor beginning the work, a preconstruction conference will be held between the Contractor, Contracting Agency, Engineer and such other interested parties as may be invited. The purpose of the preconstruction conference will be:

1. To review the initial progress schedule.
2. To establish a working understanding among the various parties associated or affected by the work.
3. To establish and review procedures for progress payment, notifications, approvals, submittals, etc.
4. To establish normal working hours for the work.
5. To review safety standards and traffic control.
6. To discuss such other related items as may be pertinent to the work.

The Contractor shall prepare and submit at the preconstruction conference the following:

1. A breakdown/schedule of values for all lump sum items.
2. A preliminary schedule of shop drawings and submittals.
3. A preliminary construction schedule. See Section 1-08.3.
4. A preliminary dewatering plan (See Section 7-08).
5. A list of material sources for acceptance if applicable.

1-08.0(2) Hours of Work

Except in the case of emergency or unless otherwise approved by the Contracting Agency or shown on the Drawings the normal straight time working hours for the contract shall be any consecutive 8-hour period between 7:00 a.m. and 6:00 p.m. of a working day with a maximum 1-hour lunch break and a 5-day work week. The normal straight time 8-hour working period for the contract shall be established at the preconstruction conference or prior to the Contractor commencing the work.

Written permission from the Engineer is required, if a Contractor desires to perform work on holidays, Saturdays, or Sundays; before 7:00 a.m. or after 6:00 p.m. on any day; or longer than an 8-hour period on any day. The Contractor shall apply in writing to the Engineer for such permission, no later than 72 hours prior to the day for which the Contractor is requesting permission to work.

Permission to work between the hours of 10:00 p.m. and 7:00 a.m. during weekdays and between the hours of 10:00 p.m. and 9:00 a.m. on weekends or holidays may also be subject to additional noise control requirements. Approval to continue work during these hours may be revoked at any time the Contractor exceeds the Contracting Agency's noise control regulations or complaints are received from the public or adjoining property owners regarding the noise from the Contractor's operations.

The Contractor shall have no claim for damages or delays should such permission be revoked for these reasons.

Permission to work Saturdays, Sundays, holidays or other than the agreed upon normal straight time working hours Monday through Friday may be given subject to certain other conditions set forth by the Contracting Agency or Engineer. These conditions may include but are not limited to:

1. The Engineer may require designated representatives to be present during the work. Representatives who may be deemed necessary by the Engineer include but are not limited to: survey crews; personnel from the Contracting Agency's material testing lab; inspectors; and other Contracting Agency employees when in the opinion of the Engineer, such work necessitates their presence.
2. Requiring the Contractor to reimburse the Contracting Agency for the costs in excess of straight-time costs for Contracting Agency during such times.
3. Considering the work performed on Saturdays, Sundays, and holidays as working days with regards to the contract time.
4. Considering multiple work shifts as multiple working days with respect to contract time even though the multiple shifts occur in a single 24-hour period.

1-08.0(3) Reimbursement for Overtime Work of Contracting Agency Employees

Where the Contractor elects to work on a Saturday, Sunday, or holiday, or longer than an 8-hour work shift on a regular working day, as defined in the Standard Specifications, such work shall be considered as overtime work. On all such overtime work, a construction observer may be present, and possibly others may be required at the discretion of the Contracting Agency and Engineer. In such case, the Contracting Agency may deduct the costs in excess of the straight-time costs incurred by the Contracting Agency for the overtime hours. The Contractor authorizes the Engineer to deduct such costs from the amount due or to become due to the Contractor.

1-08.3 Progress Schedule

1-08.3(1) General Requirements

Section 1-08.3(1) is supplemented with the following:
(Local Agency SP)

Contractor shall solicit input on manufacturing and delivery times from critical, long-lead and/or significant equipment and material suppliers and subcontractors. Critical and long-lead equipment or materials shall be identified and scheduled, and will include, but not be limited to, the following:

1. Pumps
2. Electrical panels
3. Generators
4. Custom vaults and wet well structures

Once the preliminary schedule is accepted by the Engineer, all subcontractors shall be made aware and sign off on the schedule. This will be done and documented early on at a weekly construction meeting.

To accommodate the desired information and the required schedule updates, Contractor shall use the latest revision of Primavera systems (Primavera P6) to perform scheduling functions. The Contractor's attention is directed to the format/content of the schedule of values. Given appropriate consolidation and expansion, this list shall serve as a starting point. The project schedule shall be in sufficient detail that progress of the Work can be evaluated accurately at any time during the performance of the contract.

The Contractor shall employ a person or firm with at least ten years of construction and scheduling experience who is qualified to prepare detailed construction schedules. Evidence of construction experience and successful scheduling (i.e., work completed on schedule) on at least three (3) projects in the last five years shall be provided. Provide schedules and contact information for each of the projects.

Contractor shall provide Engineer with resume and other pertinent information on the proposed scheduler. If the Engineer determines that the qualifications are not met, the Engineer can direct the Contractor to provide a different scheduler that meets the qualifications at no additional cost to the Contracting Agency.

The schedule shall begin with the date of issuance of the Notice to Proceed and conclude with the date of the final completion. The total float belongs to the project and shall not be for the exclusive use or benefit of any party.

The project schedule shall be updated monthly and the Contractor shall submit one (1) PDF copy and one (1) backup copy of the schedule using the backup routine provided in the scheduling software. Processing of pay requests will be contingent upon receipt of updated schedules. In addition to the project schedule, the Contractor shall submit a written two-week outlook activity schedule to the Engineer at the weekly progress meetings. The activity schedule shall indicate the Contractor's proposed activities for the forthcoming two weeks. Submittal of the weekly schedule does not relieve the Contractor of the requirement to submit and update the project schedule as required herein.

Time is of the essence on this project. Therefore, should schedule slippage occur, the Contractor is required to take appropriate measures to get the project back onto the approved schedule. The Contractor will not be allowed to continually let the schedule slip. Contractor shall adjust his forces, equipment and work schedules as may be necessary to get the project back on schedule to ensure completion of the work within the prescribed contract time. Contractor shall provide a plan of action and execute it accordingly to the satisfaction of the Engineer. Failure to do so will result in delay of progress payment(s) and/or a reduction in progress payment(s).

1-08.3(2)A Type A Progress Schedule

Section 1-08.3(2)A is revised to read as follows:
(Local Agency SP)

A Type A progress schedule will not be accepted by the Engineer.

1-08.3(2)B Type B Progress Schedule

The first paragraph and the first sentence of the second paragraph of Section 1-08.3(2)B are revised to read as follows:
(Local Agency SP)

The Contractor shall submit a preliminary Type B Progress Schedule depicting the entire project prior to the preconstruction conference. The preliminary Type B Progress Schedule shall comply with all of these requirements and the requirements of Section 1-08.3(1).

The Contractor shall submit four (4) hard copies, one (1) PDF copy and one (1) backup copy using the backup routine provided in the scheduling software of the revised Type B Progress Schedule depicting the entire project no later than 21-calendar days after the preconstruction conference. Contractor shall address all of the Engineer's comments on the preliminary Type B Progress Schedule.

The last paragraph of Section 1-08.3(2)B is revised to read as follows:
(Local Agency SP)

The Engineer will evaluate the Type B Progress Schedule and accept or return the schedule for corrections within 15 calendar days of receiving the submittal. The accepted Type B Progress Schedule shall establish the baseline schedule. The preliminary construction schedule shall remain in effect until the baseline schedule is accepted by the Engineer. Acceptance of the Type B Progress Schedule is for general compliance of the contract requirements and does not impose upon the Contracting Agency any warranty that all contract requirements have been addressed, met, or modified in the schedule. If it is determined that the schedule did not include modified contract requirements, the Contractor will modify its schedule without affecting the Contract Time at no additional cost to the Contracting Agency.

1-08.3(2)C Construction Sequencing and Constraints

Section 1-08.3(2)C is added as the following:
(Local Agency SP)

Continuous operation of the Contracting Agency's facilities is of critical importance. The Contractor shall schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified. The Contractor shall not proceed with work affecting a facility's operation without obtaining Contracting Agency's and Engineer's advance written approval of the need for, and duration of, such work.

Where existing facilities are to be modified during the course of work, the Contractor shall obtain Engineer's review of submittals for temporary shutdown, demolition, modification, connections between new and existing work, and other related work and shall conform to other Contract conditions as applicable.

The Contractor shall be responsible for developing the sequence of the work and for ensuring that current operations are not interrupted or compromised.

At least two weeks prior to starting the work, Contractor shall coordinate with the Engineer and Contracting Agency's representative to develop a work schedule which will permit facilities to function as normally as practical. A portion of the construction work may be required to be performed outside normal working hours to avoid undesirable conditions. The Contractor shall do this work at such times and at no additional cost to the Contracting Agency. Connections between existing facilities and new work shall not be made until all necessary inspection and tests have been completed on the new work and the new work is found to conform in all respects to the requirements of the Contract Documents.

Connection to existing services or utilities, or other work that requires temporary shutdown of any existing operations or utilities, shall be planned in detail with appropriate scheduling of the work and coordinated with the Contracting Agency or Engineer. The approved schedule for shutdown or restart shall be indicated on the Contractor's Progress Schedule, and at least seven (7) calendar days of advance written notice shall be given to the Contracting Agency and Engineer so that they may witness the shutdown, tie-in, and startup.

The Contracting Agency and Engineer consider the Contractor's schedule and construction sequencing to be paramount to ensure that the work is properly planned, coordinated, and executed. A number of pump stations feed or are fed by the facilities that will be replaced by the work under this contract. Those pump stations are currently and continuously receiving and pumping sewage and their functions shall not be interrupted except as specified herein or as specifically allowed by Contracting Agency. The Contractor shall properly coordinate and execute the work to avoid interference with normal operations. Work during low flow periods (between the hours of 12 am and 5 am) and sewer bypassing may be required to complete portions of the work. Such work shall be minimized to the extent possible through proper sequencing and execution of the work.

1-08.3(2)E Weekly Progress Meetings

Section 1-08.3(2)E is added as the following:
(Local Agency SP)

To enable orderly review during progress of the work, and to provide for systematic discussion of problems, the Engineer will conduct weekly progress meetings with the Contractor throughout the construction period. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling and resolve other problems that may develop.

Agenda Items

The Contractor shall, to the maximum extent practicable, advise the Engineer at least 24 hours in advance of project meetings regarding items to be added to the agenda.

Minutes

The Engineer will compile a summary of the discussion of each project meeting and will furnish copies to the Contracting Agency and Contractor. Recipients of copies may make and distribute copies as they deem necessary.

Attendance

These meetings shall be conducted by the Engineer and shall be attended by the Contractor's superintendent and representatives of electrical subcontractors, utilities and/or others that are active or critical in the planning or execution of the pending work. The Contractor may invite subcontractors, materials or equipment suppliers, and others to attend project meetings in which their aspect of the work is involved.

Meeting Schedule and Location

Progress meetings will be held weekly. Engineer and Contractor will establish a mutually acceptable day and time for meetings. Meetings will be held at the **Central Kitsap Wastewater Treatment Plant** unless mutually agreed upon otherwise.

Agenda

A minimum agenda for these meetings is as follows:

1. Review, and revise as necessary, minutes of previous meetings and status of previously identified action items.
2. Review progress of the work since last meeting, including status of submittals for review.
3. Discuss any issues or deficiencies with the work and necessary corrective action.
4. Discuss scheduling of any required Special Inspections or tests associated with work to be completed.
5. Review status of equipment and materials fabrication/shipments.
6. Identify issues that impede planned progress, or which impact operations of existing facilities.
7. Compare status of completion to detailed schedule and identify any activities that are behind schedule. Discuss corrective measures and procedures to regain schedule.
8. Review temporary water pollution/erosion control.
9. Review outstanding contract change issues and claims.
10. Review design modifications and documentation for change orders. Discuss any cost or schedule impacts.
11. Verify Contractor's record drawings are current.
12. Review progress payment requests.

Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the discussions and decisions of the meeting.

Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.

Challenges to minutes shall be settled as a priority portion of “old business” at the next regularly scheduled meeting.

1-08.3(3) Schedule Updates

The first paragraph of Section 1-08.3(3) is revised to read as follows:
(Local Agency SP)

Contractor shall submit updated schedules on a monthly basis. In addition, the Engineer may request a schedule update when any of the following events occur:

1. The project has experienced a change that affects the critical path.
2. The sequence of work is changed from that in the approved schedule.
3. The project is significantly delayed.
4. Upon receiving an extension of Contract time.

1-08.4 Prosecution of Work

Section 1-08.4 is revised to read as follows:
(June 27, 2011 APWA GSP)

1-08.4 Notice to Proceed and Prosecution of the Work

Limited 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. The Contractor shall not commence with the Preconstruction Phase Work until the Limited Notice to Proceed has been given by the Contracting Agency or the Engineer. The Contractor shall commence activities associated with the Preconstruction Phase Work within ten days of the Limited Notice to Proceed Date, unless otherwise approved in writing. The Contractor shall diligently pursue the work associated with the Preconstruction Phase so that it is completed within the time specified in the contract. Voluntary shutdown or slowing of operations by the Contractor shall not relieve the Contractor of the responsibility to complete the work within the time(s) specified in the contract.

Notice to Proceed with Construction will be given after the Preconstruction Phase Work has been satisfactorily completed. The Contractor shall not commence with the Construction Phase Work until the Notice to Proceed with Construction has been given by the Contracting Agency or the Engineer. The Contractor shall commence construction activities on the project site within ten days of the Notice to Proceed with Construction Date, unless otherwise approved in writing. The 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 the Contractor shall not relieve the Contractor of the responsibility to complete the work within the time(s) specified in the contract.

No work shall be performed on the site until a COVID-19 Health and Safety Plan (CHSP) has been prepared in conformance with Section 1-04.3(3) of these special provisions.

1-08.5 Time for Completion

The first paragraph of Section 1-08.5 is supplemented with the following:
(Local Agency SP)

If the 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.

The third and fourth paragraphs of Section 1-08.5 are deleted and replaced with the following:
(Local Agency SP)

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. Each week the Engineer will provide the Contractor a statement that shows the number of working days: (1) charged to the contract the week before; and (2) specified for the completion of the Preconstruction Phase work. The statement will also show the nonworking days and any partial or whole day the Engineer declares as unworkable.

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. Each week the Engineer will provide the Contractor a statement that shows the number of working days: (1) charged to the contract the week before; (2) specified for the physical completion of the contract; and (3) remaining for the physical completion of the contract. The statement will also show the nonworking days and any partial or whole day the Engineer declares as unworkable.

The statements shall be deemed accepted and correct unless the Contractor files a written protest of any alleged discrepancies in the statement within 10 calendar days after the date of each statement. To be considered by the Engineer, the protest shall be in sufficient detail to enable the Engineer to ascertain the basis and amount of time disputed. If the Contractor elects to work 10 hours a day and 4 days a week (a 4-10 schedule) and the fifth day of the week in which a 4-10 shift is worked would ordinarily be charged as a working day then the fifth day of that week will be charged as a working day whether or not the Contractor works on that day.

The sixth paragraph and the subparagraphs of Section 1-08.5 are deleted and replaced with the following:
(Local Agency SP)

The Engineer 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 Project Engineer 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 per Section 1-07.24

Section 1-08.5 is supplemented with the following:
(Local Agency SP)

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 **30** working days after the Limited Notice to Proceed Date.
2. Substantial Completion. All work under this Contract shall be substantially complete within **260** working days after the Notice to Proceed Date.
3. Physical Completion. All work under this Contract shall be physically complete within **290** working days after the Notice to Proceed Date.

The Contractor is cautioned that part of the work in this Contract may be performed only during certain periods of the day (e.g., connections to the existing sanitary sewer system, bald eagle nesting restrictions established by permit conditions), certain times of the year (e.g., WDFW Fish Window restrictions established by permit conditions) and favorable weather conditions, and as such, the Contractor shall plan and execute the work accordingly. Liquidated damages will be applied to any working days that exceed the time frames stipulated above.

1-08.8(1) Abnormal Weather Conditions

Section 1-08.8(1) is added as follows:
(Local Agency SP)

Precipitation as rain, hail or snow, low temperature, a 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 precipitation greater than the following, temperatures less than the following, and wind velocities greater than the following, cannot be reasonably anticipated. For each day determined to be abnormal as determined by the Construction Manager and approved by the Owner, one day shall be added to the contract duration at no additional cost to the Owner by written change order.

1. Daily rainfall equal to or greater than 0.50 inches during a month when the monthly rainfall exceeds the normal monthly average by 15 to 100 percent.
2. Daily rainfall equal to or greater than 0.20 inches during a month when the monthly rainfall exceeds the normal monthly average by more than 100 percent.
3. Daily rainfall equal to or greater than 1.0 inch at any time.
4. Daily maximum temperature equal to or less than 20 degrees F during a week when the maximum daily temperature never exceeds 35 degrees F.
5. Daily maximum temperature equal to or less than 25 degrees F during a week when the maximum daily temperature never exceeds 30 degrees F.
6. Daily maximum temperature equal to or less than 15 degrees F at any time.
7. 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.

To preclude the difficulties of actual measurement, the parties hereto agree that weather data at the site of the work shall be expressly deemed to be the same as that measured at the Seattle-Tacoma International Airport by the Environmental Data and Information Service of the National Oceanic and Atmospheric Administration ("NOAA") of the U.S. Department of Commerce.

For the purposes of this section, a "month" shall mean a calendar month and a "week" shall mean a calendar week of Sunday through Saturday.

1-08.9 Liquidated Damages

The third paragraph of Section 1-08.9 is revised as follows:
(Local Agency SP)

Replace all references to “Physical Completion” with the words “Substantial Completion.”

The fourth paragraph of Section 1-08.9 is deleted and replaced with the following:
(Local Agency SP)

When the Contract Work has progressed to the extent that the Engineer has determined the Contract Work is substantially complete, the Engineer will notify the Contractor in writing of the Substantial Completion Date. For overruns in contract time occurring after the substantial completion date, the formula for liquidated damages shown above will not apply. Liquidated damages shall be assessed at **one thousand five hundred ($1,500) dollars per day** until substantial completion is achieved. When the Contract Work is physically complete, the Engineer will notify the Contractor in writing of the Physical Completion Date. For overruns in contract time occurring after the physical completion date, actual damages will be assessed based on the direct engineering, Contracting Agency, and other related costs assignable to the project that are incurred by the Contracting Agency until the Contractor has fulfilled all the obligations under the Contract and submitted all documentation required by the Contract and the law

and the Engineer establishes the Final Completion Date. The Contracting Agency may offset these costs against any payment due Contractor. Contractor shall complete the remaining work that is subject to liquidated damages as promptly as possible. Upon request by the Engineer, the Contractor shall furnish a written schedule for completing the remaining physical work on the Contract.

1-08.10 Termination of Contract

Section 1-08.10 is supplemented with the following:
(Local Agency SP)

In the event that funding for this project is withdrawn, reduced or limited in any way after the effective date of this Contract, the Contracting Agency may summarily terminate this Contract notwithstanding any other termination provision of this Contract. Termination under this paragraph shall be effective upon the date specified in the written notice of termination sent by the Contracting Agency to the Contractor. After the effective date, no charges incurred under this Contract are allowable.

END OF SECTION 1-08

1-09 Measurement and Payment

1-09.1 Measurement of Quantities

Section 1-09.1 is revised with the following:
(Local Agency SP)

Delete the tenth paragraph beginning with the words “Linear Foot…” and replace with the following:

Linear Foot - Linear feet shall be measured along the pipe alignment and shall include the length through the elbows, tees, and fittings for the pay limits as shown on the Drawings. No adjustments will be made in the length for the slope, uneven contours, overlap of materials, repairs or wasted material.

1-09.2(1) General Requirements for Weighing Equipment

Section 1-09.2(1) is supplemented with the following:
(Local Agency SP)

The Contractor shall notify the Engineer not less than one working day prior to delivering materials which are measured and paid for by weight on the project. Certified weights must be issued at the source.

The Contractor shall provide a licensed public weigh master. The licensed weigh master shall issue weight tickets to the truck driver for acceptance of the material on the project by the Engineer. No materials measured and paid for by weight will be accepted without certified weight tickets from a platform scale in accordance with Section 1-09.2(3). The certified weight tickets shall be given to the Project Inspector on the day of delivery for each truckload delivered. Pay quantities will be prepared on the basis of these weight tickets, and tickets not received by the Inspector will not be honored for payment.

Truck loads must conform to legal load limits. In case of overload, the difference between overload and maximum legal load will not be paid for. If there are repeated instances of overloading, the proper enforcement authorities will be notified.

1-09.2(7) Bid Item Descriptions for Measurement and Payment

Section 1-09.2(7) is added as follows:
(Local Agency SP)

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 Owner's Representative. The 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 Owner's Representative measurements shall be used.

Measurement and Payment shall be made in accordance with Section 1-04.6 for the following bid items:

Bid Items	Bid Item Name	Measurement/Payment Description
1A, 1B	Preconstruction Work Phase	The lump sum shall include work required during the Preconstruction Work Phase as described in Section 1-04.3(1) of the Special Provisions.
2A, 2B	Final Cleanup and Restoration	The lump sum shall include final cleanup and restoration of all paved and unpaved surfaces and areas disturbed by construction to conditions equal to, or better than existing.

Bid Items	Bid Item Name	Measurement/Payment Description
3A, 3B	Surveying	The lump sum shall include survey efforts required to locate and construct the improvements as well as as-built the completed work.
4A, 4B	Project Record Drawings	The lump sum shall include work associated with maintaining, updating, modifying the Contract Drawings to reflect modifications in the completed work that differ from the design information shown on the Contract Drawings. Incremental payments, determined by dividing the working days in each pay period by the total working days under the contract and then multiplying by 60% of the lump sum amount, will be paid for each monthly update. No more than 60% of the total lump sum amount will be paid for monthly updates. The balance of the lump sum will be paid upon delivery and approval of acceptable record drawings by the Engineer near the end of physical construction. The lump sum for this bid item shall be at least 0.5% of the total bid amount.
5A, 5B	Type B Schedules	The unit price per month shall include all work associated with furnishing progress schedules, weekly look-ahead schedules, and schedule updates. Payment shall be made on a monthly basis for approved schedules. Progress payments will be contingent upon receipt and approval of the monthly schedule updates. No payment shall be made for the draft or baseline construction schedules as these shall be considered incidental to the contract. Payment for approved monthly schedule updates will be based on the amount shown in the bid schedule. The unit price for this bid item shall be at least five hundred dollars per month per schedule.
6A, 6B	Minor Change (Allowance)*	This item is reserved as a construction contingency for “Minor Changes” which may occur during the course of the work. This budget allowance will facilitate minor additional work without the need for a Contract amendment. The Engineer will still prepare a work change directive and the Contractor will still prepare cost proposals for work that is agreed to be out of scope. The Contracting Agency’s approval will be obtained prior to authorization of such work. See Section 1-09.6 for additional information.
7A, 7B	Mobilization and Demobilization	The lump sum shall include preconstruction expenses and the cost of preparatory work and operations performed by the Contractor, excluding work included in Bid Item 1, Preconstruction Work Phase. This work shall include, but not be limited to, the work identified in Section 1-09.7 of the Special Provisions. Mobilization and demobilization shall not exceed 10% of the total contract amount. Payment for mobilization and demobilization will be limited to 70% and 30%, respectively, of the total bid amount.

Bid Items	Bid Item Name	Measurement/Payment Description
8A, 8B	Operation and Maintenance Manuals	The lump sum shall include work required to prepare and submit operations and maintenance data. Payment for the initial submittal and subsequent re-submittals will not exceed 50% of the total bid amount. The remaining amount will be paid upon receipt and approval of the final operation and maintenance manual. The lump sum for this bid item shall be at least 0.5% of the total bid amount.
9A, 9B	Dewatering (Allowance)*	This Bid item is an allowance for dewatering for control of surface and groundwater. The actual cost of dewatering will be paid for in accordance with Section 1-09.6 of the Special Provisions and Section 31 23 43.
10A, 10B	Bypass Pumping	The lump sum shall include all work associated with sewage bypass pumping including all related labor, materials, design, engineering, submittals, pumps, hoses, fuel, piping, fittings, appurtenances, and other equipment required to furnish, install, monitor, protect, maintain, remove, etc. temporary sewer bypass systems necessary to complete the work.
11A, 11B	Excavation Support Systems	The lump sum shall include all work required to comply with all requirements of the Washington State Safety Code relating to excavation, trenching, and shoring: "Safety Standards for Construction Work", Chapter 295-155 WAC Part N. The lump sum shall also include all temporary sheeting, shoring and bracing or equivalent methods, including design and engineering fees associated thereof, as well as furnishing, constructing, removing, and disposing of all temporary sheeting, shoring, and bracing. The lump sum shall be full compensation for all excavation, backfilling, compaction, and other work required when extra excavation is used in lieu of shoring. If select or imported backfill material is required for backfilling within the neat line trench limits excavation, it shall also be required as backfill material for the extra excavation and overbreak at the Contractor's expense.
12A, 12B	Gravel Backfill for Foundations ~~(Allowance)*~~	The unit price shall include all work associated with furnishing and installing gravel backfill for foundations as shown on the drawings, where unsuitable foundation materials are encountered, or as directed by the Engineer or Owner. The unit price shall also include all costs associated with excavating, removing, and disposing of unsuitable materials; furnishing and installing geosynthetic fabric where necessary to stabilize the soils; and hauling, furnishing, installing, and compacting gravel backfill for foundations.

Bid Items	Bid Item Name	Measurement/Payment Description
13A, 13B	Crushed Surfacing Base Course	The unit price shall include all work associated with hauling, furnishing, placing, and compacting crushed surfacing base course. The unit price shall also include the removal and proper disposal of any material being replaced by the crushed surfacing base course.
14A, 14B	Crushed Surfacing Top Course	The unit price shall include all work associated with hauling, furnishing, placing, and compacting crushed surfacing top course. The unit price shall also include the removal and proper disposal of any material being replaced by the crushed surfacing top course.
15A, 15B	HMA Pavement	The unit price shall include all work associated with saw cutting existing asphalt, removal and proper disposal of subgrade and all existing asphalt being replaced by the new asphalt, preparing the sub-grade for paving; cleaning existing asphalt; joint sealing; grinding at transitions; placing tack coat; furnishing, hauling, placing, and compacting the asphalt pavement; adjusting all utility covers and monument case covers to the new grade as necessary; replacing all disturbed pavement striping and markings; and all other incidental work to complete the pavement.
16A, 16B	Temporary Erosion and Sediment Control	The lump sum shall include preparing the temporary erosion and sediment control (TESC) plan and updating it when necessary as well as furnishing, installing, maintaining, and removing TESC measures, as appropriate and required.
17A, 17B	PS 19 Submersible Pumps, PS 31 Submersible Pumps, respectively	This lump sum shall include purchase of the pumps, excluding tax and installation. The Contracting Agency has elected to purchase the pumps on a sole source basis and has received a “not to exceed” price that includes all equipment, delivery to the job site, submittals, testing, O&M Manuals, start-up services, and all other requirements specified or referenced in Section 221329.16 of the Special Provisions. A copy of the Manufacturer’s “not to exceed” price is included in Appendix E.
18A	PS 19 Mechanical Work	This lump sum shall include all work associated with the pump station mechanical activities, including but not limited to, all work required to install the pumps, valves, sanitary sewer piping (force mains and gravity sewers), pipe supports, flow meter, pig launch, bypass connection, connections to the existing sewer system, and all associated necessary items.
18B	PS 31 Mechanical Work	This lump sum shall include all work associated with the pump station mechanical activities, including but not limited to, all work required to install the pumps, valves, sanitary sewer piping (force mains and gravity sewers) pipe supports, connections to the existing sewer system, and all associated necessary items.

Bid Items	Bid Item Name	Measurement/Payment Description
19A, 19B	PS 19 Electrical Work, PS 31 Electrical Work, respectively	This lump sum shall include all work associated with the pump station electrical and I&C activities, including but not limited to, all work required to install variable frequency drives, incoming electrical utility service, trench and inground facilities for electrical utility, generator, flow meters, conduits/wires, programming, building wiring and lights, instrumentation systems, control systems, and all associated necessary items.
20A	PS 19 Wet Well Modifications	The lump sum shall include all work associated with demolition of the existing wet well and dry well as described on Drawing D19-2 as well as all rehabilitation of the existing wet well. Rehabilitation shall include but not be limited to framing and pouring the reinforced concrete top slab; furnishing and installing the access hatches, davit sleeves, and valve boxes; constructing the grout fillets; and cleaning and recoating the interior walls.
20B	PS 31 Wet Well Modifications	The lump sum shall include all work associated with demolition of the existing pump station as described on Drawing D31-2 as well as all rehabilitation necessary to convert the existing wet well to a functional manhole. Rehabilitation shall include but not be limited to framing and pouring the new manhole top slab; furnishing and installing the manhole frame and cover; constructing the grout fillets; and cleaning and recoating the interior walls. This bid item shall also include all costs associated with furnishing and installing the new wet well, valve vault, access hatches, and davit sleeves; constructing the grout fillets; and coating the interior and exterior of the new wet well.
21A	PS 19 Diesel Pump	This lump sum shall include all work associated with the purchase and installation of the diesel pump, diesel fuel tank, diesel monitoring port, and all associated fuel system piping and related appurtenances. This lump sum also includes testing and startup of the diesel pump.
21B	PS 31 Retaining Walls	The lump sum shall include all work associated with the construction of new concrete retaining walls. Work shall include excavating as needed for the wall and site preparation; framing and pouring the wall footings and wall sections; and furnishing and installing drainage rock and geotextile separation fabric.
22A	PS 19 Control Building	The lump sum shall include all work associated with constructing the pump station building, except for pumps, mechanical equipment, and electrical/I&C work which are paid for separately. Work shall include finish grading, compacted base, footings, footing drains, slab and pads, walls, roofing, downspouts and roof drains, insulation, and all associated appurtenances.

Bid Items	Bid Item Name	Measurement/Payment Description
22B	PS 31 Storm Drainage	The lump sum shall include all work associated with construction of the storm drainage system at PS 31, including but not limited to all storm sewer piping, catch basins, splash pad, and associated necessary items. The lump sum shall also include all required testing and inspections.
23A	PS 19 Storm Drainage	The lump sum shall include all work associated with construction of the storm drainage system at PS 19, including but not limited to all storm sewer piping, drains, cleanouts, catch basins, dispersion trenches and associated necessary items. The lump sum shall also include all required testing and inspections.
24A	Permeable Concrete Pavement	This lump sum shall include all work associated with constructing the permeable concrete paving system, including but not limited to excavation and disposal of native material to provide room for the new pavement; preparing the sub-base soils; forming and pouring the concrete curbs; and furnishing and installing the subbase, base, bedding, geotextile fabric, concrete pavers, and permeable joint materials.
25A, 23B	PS 19 Miscellaneous Site Work, PS 31 Miscellaneous Site Work, Respectively	The lump sum shall include all Work required to construct the upgrades and modifications to the respective pump station that are not specifically included in other Bid Items. This shall include but not be limited to demolition, site grading, fencing, painting; and other miscellaneous work
26A	Existing Utility Relocation (Allowance)	This Bid item is an allowance for relocating existing utilities directly impacted by construction of the proposed upgrades. The actual costs associated with this Bid item will be paid for in accordance with Section 1-09.6 of the Special Provisions.
27A, 24B	PS 19 Facility Testing and Startup PS 31 Facility Testing and Startup	The lump sum shall include all Work required to test and startup each pump station, including but not limited to coordinating with the Owner and Engineer and providing specified training for the Owner on the equipment. At least one (1) percent of the bid amount for each schedule shall be allocated for payment of facility startup and testing activities for each schedule.

* Allowance - For the purpose of establishing a common basis for evaluating bids, an arbitrary quantity and/or bid amount for this item has been shown on the bid form and does not necessarily represent the quantity and/or cost that may be necessary for the work. The Variation in Estimated Quantities provisions of Section 1-04.6 of the Standard Specifications shall not apply to this item. Quantities and/or payments will be determined in the field as work progresses.

1-09.6 Force Account

Section 1-09.6 is supplemented with the following:
(Local Agency SP)

The Contracting Agency has estimated and included in the Proposal, a dollar amount for the Bid item "Minor Changes (Allowance)" (also referenced as Force Account), only to provide a common proposal for Bidders. This dollar amount shall become a part of Contractor's total bid. However, the Contracting

Agency does not warrant expressly or by implication that the actual amount of work will correspond with the estimate. Payment will be made on the basis of the amount of work actually authorized by Engineer through Work Directives.

A complete list including name, labor classification and weighted wage rate of all personnel to be performing "Minor Changes" work shall be given to the Engineer before "Minor Changes" work starts. A list including all pertinent information, such as equipment name and model, year, engine size, bucket size, capacity, etc., for all equipment to be used for performance of "Minor Changes" work shall also be furnished to the Engineer prior to beginning "Minor Changes" work.

1-09.7 Mobilization

The second and third paragraphs and the associated subparagraphs of Section 1-09.7 are deleted and replaced with the following:
(Local Agency SP)

"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. Securing private agreements for temporary land use on adjacent properties as needed and providing a copy of all such agreements to the Engineer as required by Section 1-07.24.
6. All other pre-construction expenses and costs for preparatory work and operations performed by the Contractor.
7. All demobilization costs, including removal of equipment, excess materials, trailer, and general cleanup.

1-09.9 Payments

Delete the first four paragraphs of Section 1-09.9 and replace them with the following:
(March 13, 2012 APWA GSP)

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 Project Engineer to determine the Work performed on a monthly basis. A breakdown is not required for lump sum items that include a basis for incremental payments as part of the respective Specification. Absent a lump sum breakdown, the Project Engineer will determine the incremental payment based on the information available. The Project Engineer'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 Engineer. 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.

The value of the progress estimate will be the sum of the following:

1. Unit Price Items in the Bid Form — the approximate quantity of acceptable units of work completed multiplied by the unit price.
2. Lump Sum Items in the Bid Form — based on the approved Contractor's lump sum breakdown for that item, or absent such a breakdown, based on the Engineer's determination.
3. Materials on Hand — 100 percent of invoiced cost of material delivered to Job site or other storage area approved by the Engineer.
4. Change Orders — entitlement for approved extra cost or completed extra work as determined by the Engineer.

Progress payments will be made in accordance with the progress estimate less:

1. Retainage per Section 1-09.9(1).
2. The amount of Progress Payments previously made.
3. Funds withheld by the Contracting Agency for disbursement in accordance with the Contract Documents.

Progress payments for work performed shall not be evidence of acceptable performance or an admission by the Contracting Agency that any work has been satisfactorily completed. The determination of payments under the contract will be final in accordance with Section 1-05.1.

1-09.9(2) Contracting Agency's Right to Withhold and Disburse Monies Due

Section 1-09.9(2) is added as the following:
(Local Agency SP)

In addition to monies retained pursuant to RCW 60.28 and subject to RCW 39.04.250, RCW 39.12, and RCW 39.76, the Contractor authorizes the Engineer to withhold progress payments due or deduct an amount from any payment or payments due the Contractor which, in the Engineer's opinion, may be necessary to cover the Contracting Agency's costs for or to remedy the following situations:

1. Work not in accordance with the Contract Documents.
2. Defective work or equipment cost or liability that may occur to Contracting Agency as a result of Contractor's, Subcontractors or Suppliers failure to perform.
3. Damage to another contractor when there is evidence thereof and a claim has been filed.
4. Where the Contractor has not paid fees or charges to public authorities or municipalities which the Contractor is obligated to pay.
5. Utilizing material, tested and inspected by the Engineer, for purposes not connected with the Work (See Section 1-05.6).
6. Landscape damage assessments (See Section 1-07.16.
7. For overtime work performed by the Engineer or Contracting Agency personnel (See Section 1-08.0(3)).
8. Liquidated damages associated with exceeding the Contract Time (See Section 1-08.9 Liquidated Damage).
9. Failure of the Contractor to perform any of the Contractor's other obligations under the contract, including but not limited to:
    a. Failure of the Contractor to protect survey stakes, markers, etc., or to provide adequate survey work as required by Section 1-05.4.
    b. Failure of the Contractor to correct defective or unauthorized equipment or work (Section 1-05.7).

c. Failure of the Contractor to furnish a Manufacture's Certificate of Compliance in lieu of material testing and inspection as required by Section 1-06.3.

d. Failure to submit Intent to Pay Prevailing Wage forms, or correct underpayment to employees of the Contractor or subcontractor of any tier as required by Section 1-07.9.

e. Failure of the Contractor to pay worker's benefits (Title 50 and Title 51 RCW) as required by Section 1-07.10.

f. Failure of the Contractor to submit and obtain acceptance of a progress schedule per Section 1-08.3.

Lack of construction progress based upon the Engineer's review of the Contractor's approved progress schedule which indicates the Work will not be completed within the Contract Time may also be a basis for withholding progress payments due or to deduct an amount from any payment or payments due the Contractor. The amount withheld under this subparagraph will be based upon the liquidated damages amount per day set forth in Contract Documents multiplied by the number of working days the Contractor's approved progress schedule, in the opinion of the Engineer, indicates the Contract may exceed the Contract Time.

The Contractor authorizes the Contracting Agency to act as agent for the Contractor disbursing such funds as have been withheld pursuant to this section to a party or parties who are entitled to payment. Disbursement of such funds, if the Contracting Agency elects to do so, will be made only after giving the Contractor fifteen (15) calendar days prior written notice of the Contracting Agency's intent to do so, and if prior to the expiration of the 15-calendar day period, no legal action has commenced to resolve the validity of the claims, and the Contractor has not protested such disbursement.

A proper accounting of all funds disbursed on behalf of the Contractor in accordance with this section will be made. A payment made pursuant to this section shall be considered as payment under the terms and conditions of the Contract. The Contracting Agency shall not be liable to the Contractor for such payment made in good faith.

If legal action is instituted to determine the validity of the claims prior to expiration of the 15-day period mentioned above, the Engineer will hold the funds until determination of the action or written settlement agreement of the parties.

1-09.11(1) Disputes Review Board

Delete Sections 1-09.11(1,) 1-09.11(1)A, and 1-09.11(1)B and replace with the following:
(Local Agency SP)

The formation and use of a dispute resolution board is not included in this Contract.

1-09.13(3)A Administration of Arbitration

The third paragraph of Section 1-09.13(3)A is revised to read as follows:
(October 1, 2005 APWA GSP)

The Contracting Agency and the Contractor mutually agree to be bound by the decision of the arbitrator, and judgment upon the award rendered by the arbitrator may be entered in the Superior Court of the county in which the Contracting Agency's headquarters are located. The decision of the arbitrator and the specific basis for the decision shall be in writing. The arbitrator shall use the contract as a basis for decisions.

END OF SECTION 1-09

1-10 Temporary Traffic Control

1-10.2(1) General

Section 1-10.2(1) is supplemented with the following:
(Local Agency SP)

The primary and alternate TCS shall be certified by one of the following:

1. The Northwest Laborers-Employers Training Trust
   27055 Ohio Avenue
   Kingston, WA 98346
   (360) 297-3035
   (800) 240-9112

2. Evergreen Safety Council
   12545 138th Avenue NE
   Kirkland, WA 98034
   (425) 814-3868

1-10.2(1)A Traffic Control Management

The fifth item of the first paragraph of Section 1-10.2(1)A is revised to read as follows:
(Local Agency SP)

5. Coordinating the project's activities (such as ramp closures, road closures and lane closures) with appropriate police, fire control agencies, city, or county engineering, medical emergency agencies, school districts, and transit companies at least ten (10) working days prior to beginning the work.

1-10.2(2) Traffic Control Plans

Supplement Section 1-10.2(2) with the following:
(Local Agency SP)

As a minimum, the Contractor's traffic control plan(s) shall include:

1. Drawings showing vehicular, bicycle, and pedestrian routing during each phase of the work, including permanent and temporary routing of traffic on all roadways.

2. Drawings showing the location of barricades, lighting, signing, and any other vehicular, bicycle, and pedestrian traffic control devices anticipated to be used during each phase of the work.

3. Anticipated traffic blockages resulting from construction activities.

4. Anticipated locations where temporary pipes, cables, or hoses will be placed across or parallel to roadways. Drawing details of ramps over utilities or shallow burial placement and protection cover shall be included.

5. Projected volumes of truck traffic over designated truck haul routes.

1-10.3(2)F Public Convenience and Safety

Section 1-10.3(2)F is added as the following:
(Local Agency SP)

The Contractor shall conduct all operations with the least possible obstruction and inconvenience to the local public. The Contractor shall have under construction no greater amount of work than can be prosecuted properly with due regards to the rights of the public. To the extent possible, the Contractor shall finish each section before beginning work on the next.

To disrupt local access traffic as little as possible, the Contractor shall:

1. Permit local access traffic to pass by the work zone with the least possible inconvenience or delay.
2. Maintain existing roads and streets that lie next to or inside the project limits, keeping them open and in good, safe condition at all times.
3. Remove or repair any condition resulting from the work that might impede traffic or create a hazard, and
4. Keep existing traffic signal and highway lighting systems in operation as the work proceeds. (The Contracting Agency will continue the routine maintenance on such systems).
5. Provide provisions for access by buses and emergency vehicles to streets adjacent to the work zone.

To protect the rights of abutting property owners, the Contractor shall:

1. Conduct the construction so that the least inconvenience as possible is caused to abutting property owners.
2. Maintain ready access to driveways, houses, buildings, and mailboxes along the line of work. Should it be necessary to close an individual driveway for purposes of construction, the Contractor shall present an access plan to limit the driveway closure to less than 24-hours, unless otherwise indicated on the Drawings. Within 48-hours of the construction impeding the driveway, a drivable gravel surface shall be placed and compacted.
3. Provide ready access to pump stations and treatment facilities for operation and maintenance by Kitsap County.
4. Provide temporary approaches to crossing or intersecting roads and keep these approaches in good condition, and
5. Provide another access before closing an existing one whenever the Contract calls for removing and replacing an abutting owner's access.

The Contractor shall be responsible for providing adequate safeguards, safety devices, protective equipment, and any other needed actions to protect property in connection with the performance of the work covered by the Contract. The Contractor shall perform any measures or actions the Engineer may deem necessary to protect the public and property. The responsibility and expense to provide this protection shall be the Contractor's except that which is to be furnished by the Contracting Agency as specified in other sections of the Specifications.

Emergency traffic such as police, fire, and disaster units shall be provided access through the work site and to public and private properties at all times. The Contractor shall coordinate and perform all work in accordance with the requirements of police, fire, and other emergency services agencies.

The Contractor shall coordinate and perform all work in accordance with the requirements of all public transit and school bus service which may be operating in the project area. Safe and convenient access to the bus zones shall be provided and maintained at all times by the Contractor. The Contractor shall be liable for any damages which may result from failure to provide reasonable access or coordination.

The Contractor shall perform the work and provide access to enable solid waste pickup by solid waste collection firms at their regularly scheduled times. Contractor shall also provide access to mailboxes to enable Postal Service pickup and delivery at their regularly scheduled times.

1-10.3(2)G Construction and Maintenance of Detours

Section 1-10.3(2)G is added as the following:
(Local Agency SP)

Streets shall be closed to traffic only upon specific approval of the jurisdictional agency. Prior to the closure of any streets or roads, the Contractor shall prepare a written plan for detouring of traffic and shall submit such plan to the jurisdictional agency for acceptance. Details shall be in accordance with the requirements of the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways and such additional requirements as may be imposed by the Contracting Agency or other jurisdictional agency. Contractor is hereby informed that proposed road closures greater than 12 hours require approval by the County Council, which may take 4 to 6 weeks to process and will require specific time frames for the proposed closures. Contractor shall submit his/her traffic control plan as an early submittal at the Preconstruction Conference.

All detours, both inside and outside of the work area as required by the Contractor's operations, shall be the sole responsibility of the contractor. The design, construction and maintenance of detours and all temporary facilities required for detours shall be the sole responsibility of the Contractor.

END SECTION 1-10

1-11 Operations and Maintenance Data

Section 1-11 and its subsections are added as the following:
(Local Agency SP)

1-11.1 Schedule of O&M Data Required

The Contractor shall arrange for, and pay all costs associated with the services of the manufacturer's representative and/or others to provide and prepare operation and maintenance data for the system and/or equipment listed below:

1. Submersible sewage pumps, backup diesel pump, and associated mechanical and electrical systems.
2. Flow meters.
3. Valves.
4. Pressure sensor assemblies.
5. HVAC
6. Power generation
7. Pump control systems.
8. Other systems or equipment that may need maintenance.

1-11.2 Initial Submittal

The Contractor shall submit a draft bookmarked and searchable PDF copy of the Operations and Maintenance Manual to the Engineer for review. The PDF shall comply with Section 1-06.1(3). The initial submittal shall be received by the Engineer at least twenty (20) Working Days prior to placement of the system and/or equipment in operation. The initial submittal may be delivered in multiple parts to the Engineer.

All information shall be specifically for the installed components. Data sheets which cover multiple equipment or list options shall be marked to indicate the installed equipment, including provided options. All other equipment or options shall be crossed out. Each item in the submittal shall include, but not be limited to the following information:

1. Fly sheet indicating: Contracting Agency's name; description of equipment; manufacturer's name, address, and telephone number; and local supplier/ representative's name, address, and telephone number.
2. Detailed index indicating submittal contents, with major headings related to tabbed dividers.
3. Assembly drawings.
4. Parts list and/or bill of materials.
5. Wiring diagrams.
6. Lubrication instructions, including type and frequency.
7. Preventative and periodic maintenance summary.
8. Operating instructions.
9. Overhaul and parts replacement instructions.
10. Source for parts.
11. Testing and troubleshooting procedures.
12. Performance curves.

13. Factory and field test data.
14. List of recommended spare parts.
15. List of expendable parts (i.e., air or oil filters).
16. Warranty.

Data and manuals shall be neat, clean copies. Drawings shall be accordion-folded. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.

The Engineer will review the initial submittal and return it to the Contractor for incorporation of review comments.

1-11.3 Final Submittal

After the Contractor has addressed the Engineer's comments on the initial submittals, the Contractor shall assemble all components into an integrated document. The final submittal shall include two final bookmarked hard copies and one bookmarked and searchable PDF copy that reflects the corrections. Each hard copy shall be bound in vinyl covered, three-ring binders. The integrated document shall consist of as many volumes as necessary to contain the data. Individual binders for each component of the submittal are not required. The binder shall be organized in a consistent format with tabbed dividers for each item. Each volume shall include, but not be limited to, the following:

1. The front cover and binding edge shall have typed labels identifying the project, Contracting Agency, and volume number;
2. Detailed index indicating the contents of the volume by major headings; and
3. Oversize (larger than 11"x17") prints shall be inserted in bound-in Kraft or Kevlar envelopes, placed at the end of the applicable area or subarea.
4. Data and manuals shall be neat, clean copies. Drawings shall be accordion-folded.

The integrated document shall be submitted to the Engineer within ten (10) Working Days after Substantial Completion of the work. If the integrated document does not meet the requirements of this Section, the Engineer may return the copy to the Contractor for corrections. The submittal process shall be repeated until the integrated document is acceptable. The Contractor shall anticipate that Final Acceptance may be delayed by the Contracting Agency if the integrated document is not acceptable to the Engineer.

END OF SECTION 1-11

1-12 Internet-Based Project Management Requirements

Section 1-12 and its subsections are added as the following:
(Local Agency SP)

1-12.1 Summary

This Section specifies an Internet-based project management system, EADOC, required for use by the Contractor and the Owner for collaboration and communications of all Contract related work.

1-12.2 Submittals

Submit the following for each proposed authorized EADOC user within ten days of the effective date of the Notice to Proceed:

1. Name, title, and company affiliation.
2. Address, phone number, email address and fax number.
3. Specific job-related functions.
4. Level of authority within the Contractor's organization.
5. Level of permissions access requested for each user for accessing each EADOC module.

Submit an updated list of authorized users on a quarterly basis or more frequently as needed, to indicate users to be added or removed.

1-12.3 Project Communications

All official Project Communication and collaboration will take place in EADOC by creating and distributing documents directly within the system, or by scanning and/or uploading project documents into the system for distribution. Unless otherwise indicated, no other form of written Project Communication will be recognized.

Create submittals in EADOC's submittal module. Distribute reports, documents, samples, etc. that cannot be processed through EADOC per Section 1-06. Use EADOC to track and expedite processing submittals. Scan and/or upload support documentation into EADOC and attach to the main submittal document.

The Construction Manager or Engineer will respond to all documents using the appropriate EADOC module. All documents requiring formal signatures will be printed out in EADOC and hard copies signed and distributed. Otherwise, documents distributed electronically via EADOC will be considered official documentation. Documents requiring formal signature include:

1. Change Orders.
2. Construction Change Directives.
3. Others as determined by Owner.
4. Pay applications.

All documents will be electronically submitted to the Owner as an attachment to a transmittal created in EADOC transmittal module.

This Section shall not relieve the Contractor of its obligations to provide the Owner with Record Drawings in the physical form specified in Section 1-05.5.

1-12.4 Access Requirements

Contractor shall maintain the list of authorized users to reflect current authorized users of EADOC.

Contractor shall protect the security of the EADOC system by limiting access to authorized users only. Do not allow 'sharing' of usernames. Take appropriate precautions to maintain the security of the system.

Ensure that Owner is notified immediately of any user who is no longer authorized to use the system so that their user account can be de-activated by the EADOC Administrator.

Access will only be permitted to certain modules, in accordance with permission levels configured by the EADOC Administrator. Requests to change permission levels must be submitted to the Construction Manager.

1-12.5 Use Requirements

EADOC shall be used as the Project file storage system with a file folder structure created by the Owner to organize the Project documents.

The use of EADOC is intended to expedite and improve collaboration and written contract communication and to accurately record the flow of Contract documentation.

Contractor shall encourage its major subcontractors to utilize the Internet-based project management system, as appropriate, to improve communications and coordination within the Contractor's team.

Contractor shall abide by all policies, procedures, and standards established by the Owner for the use and application of EADOC.

Contractor shall comply with applicable laws and regulations regarding electronic transmission of documents requiring professional engineering stamps or signatures, including provision of hard copies of such documents as appropriate.

Project Communications that require the signature of authorized persons will use either:

1. An approved "image" of the official signature affixed to the document. Also provide Owner with the original signed hard copy/paper document.
2. An electronic copy or electronic image of a fully executed document containing the required signatures. Also provide Owner with the original signed hard copy/paper document.

1-12.6 Downtime

In the event that the EADOC system is temporarily unavailable, continue with Project Communications utilizing other electronic means (email) or hard copies to transmit and receive Project Communications.

Maintain records of all Project Communication during the EADOC downtime and upload the records to EADOC when it is operational.

Notify the Owner's EADOC Administrator by telephone or email when EADOC is not functional.

1-12.7 EADOC Training

Submit a proposed schedule of attendance for the EADOC training sessions including a list of back up personnel. EADOC training is mandatory for listed users of EADOC prior to use, including any training sessions scheduled by the Owner. Contractor shall provide for up to 12 hours of EADOC training for up to 3 staff. The Contractor is not required to pay EADOC for the training sessions but shall pay for the required Contractor staff to attend the training.

1-12.8 Project Management System Requirements

Provide computer hardware and software that meet the requirements of the EADOC project management software at both field office and home office location(s) where Project Communications on this Contract are generated or processed.

1-12.8(1) Modifications

EADOC is continually modified and improved in order to enhance the product and provide additional functionality. EADOC has many methods of alerting clients to changes and providing support to the end users.

1-12.8(2) Software, Hardware, and Internet Access

Minimum software requirements are as follows:

1. An Operating system such as Windows 2000 or later.
2. An Internet browser Explorer Version 6.1 or later.

Minimum hardware requirements are as follows:

1. Pentium-based (or equivalent) workstation or laptop with a minimum of 64 MB of RAM.
2. A scanning device capable of scanning a minimum of 11-inch x 17-inch color document into electronic Portable Document Format (PDF) with a minimum density of 300 dpi.
3. A full-size plan scanner.

Minimum access requirements are as follows:

1. Broadband connection using integrated Services Digital Network (ISDN), Digital Subscriber Line (DSL), or better.

Contractor shall be responsible for his costs associated with the provisions, maintenance, and upgrade of the hardware, software, and Internet access needed for using EADOC for the duration of the Contract.

Contractor shall be responsible for all software necessary to create documents in format compatible with EADOC or to convert non-electronic documents to such formats. Compatible formats include: Word, Excel, AutoCAD, and PDF.

1-12.9 Restrictions and Limitations

All Project Communications submitted to the Owner through EADOC after 3:00 PM, Monday through Friday, will be acknowledged no earlier than the following business day. For Project Communication purposes, business days and hours are defined in Section 1-01.3.

User access rights to the EADOC site will restrict access to this Contract only. Access permission levels will be established by the Owner and Construction Manager.

1-12.10 Owner Responsibility

Owner shall:

1. Provide the Contractor with EADOC Use Guidelines within seven days of the effective date of Notice to Proceed.
2. Provide user access to the EADOC system for the duration of the Contract.
3. Manage the permissions level for all users of the system.
4. Provide EADOC training for personnel using the system for each EADOC user identified by the Contractor.
5. Provide technical support (administration) for EADOC, acting solely through and at the request of the Owner.
6. Provide guidelines regarding the organization and format of the EADOC modules and the access permission requirements for each module or element thereof.
7. Allow users to upload, download, view, and markup files, based on permissions.
8. Track history of revisions and activities with respect to each document submitted or managed within EADOC.
9. Adjust and revise the folder structure as necessary to facilitate management of Project Communications.

With the prior approval of Owner, exceptions may be made to allow specific items to be transmitted, submitted, responded to, or distributed in hard copy only. In these instances, EADOC shall be used to track and expedite processing of these items. Refer to Section 1-12.5 above.

END OF SECTION 1-12

SECTION 01 59 00
TEMPORARY SEWER BYPASS SYSTEMS

PART 1 : GENERAL

1.01 SUMMARY

Work covered in this section includes the requirements for temporary sewer bypass systems. The means and methods of accomplishing and maintaining the bypassing shall be the sole responsibility of the Contractor.

Continuous operation of the Owner's facilities is of critical importance. Contractor shall schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified. Contractor shall not proceed with work affecting a facility's operation without obtaining Owner's and Engineer's advance written approval of the need for, and duration of, such work. Where existing facilities are to be modified during the course of work, the Contractor shall obtain Engineer's review of submittals for temporary bypass, temporary shutdown, demolition, modification, connections between new and existing work, and other related work and shall conform to other Contract conditions as applicable.

The Owner and Engineer consider the Contractor's schedule and construction sequencing to be paramount to ensure the work is properly planned, coordinated, and executed. A number of pump stations feed or are fed by the facilities that will be replaced by the work under this contract. Those pump stations are currently, and continuously receiving and pumping sewage and their functions cannot and shall not be interrupted except as specified herein or as specifically allowed by the Owner. The Contractor shall properly coordinate and execute the work to avoid interference with normal operations.

Contractor shall anticipate that multiple temporary sewer bypass systems and operations may be required over the duration of construction to construct the proposed improvements given the specified work constraints and separated project site locations.

Connection to existing services or utilities, or other work that requires temporary shutdown of any existing operations or utilities shall be planned in detail with appropriate scheduling of the work and coordinated with the Contracting Agency or Engineer.

Contractor shall be solely responsible for developing the sequence of the work and for ensuring that current operations are not interrupted or compromised. At least three weeks prior to starting the work, Contractor shall confer with the Engineer and Owner to develop a work schedule that will permit facilities to function as normally as practical. Certain parts of the construction work may be required outside normal working hours in order to avoid undesirable conditions, including work during low flow periods (between the hours of 12 am and 5 am). Temporary sewer bypassing may also be required to complete portions of the work. Such work shall be minimized to the extent possible through proper sequencing and execution of the work. Contractor shall do this work at such times and at no additional cost to the Contracting Agency. Connections between existing facilities and new work shall not be made until all necessary inspection and tests have been completed on the new work and the new work is found to conform in all respects to the requirements of the Contract Documents.

1.02 SUBMITTALS

A. Submit in accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions.

B. Submit details of proposed temporary sewer bypass system(s).

1. Temporary Sewage Bypass Plan(s): detailed explanation(s) of the sewer bypass system(s), including project specific drawings and complete design data showing methods and equipment to be utilized to temporarily bypass sanitary sewage systems while making connections to the existing system or installing new facilities that require the temporary bypass of the existing facilities. The bypass plan shall include:

    a. Design data, including engineering analysis and calculations for each sewer bypass system.

    b. Proposed pumping equipment.

    c. Plans and details of the proposed temporary bypass system(s).

    d. Sequencing and duration of the temporary bypass operations.

    e. Proposed temporary shutdowns.

    f. Spill cleanup plan.

    g. Assistance required of the Owner.

2. Bypass Plan shall be stamped and signed by a professional engineer registered in the State of Washington.

C. Temporary Bypass Qualifications.

1.03 CONTRACTOR RESPONSIBILITY

A. BYPASS SYSTEM REQUIREMENTS

1. Spills or bypassing of untreated or partially treated wastewater to surface waters or drainage courses is prohibited during construction. In the event accidental spills or bypassing is caused by the Contractor, Contractor shall take immediate action to contain the spill and shall be responsible for cleanup and all consequential damages. The Owner shall be entitled to employ whatever supplemental actions are deemed necessary to stop the bypassing in accordance with the General Conditions with all associated costs borne by the Contractor. Contractor shall be fully responsible for any damage that may result from inadequate or improper installation, maintenance or operation, or failure of any kind of the temporary sewer bypass system.

2. Costs incurred by the Contractor or Owner, including penalties imposed on the Owner as a result of any sewage spills caused by the Contractor, its employees, or subcontractors, shall be borne in full by the Contractor, including legal fees and other expenses to Contractor or Owner resulting directly or indirectly from the spill.

3. If the system has to be drained to complete the work, such as for a cut-over/connection, Contractor shall provide the necessary temporary pumping and/or storage equipment to drain or remove the sewage from the excavation and/or system.

4. Precautions and Protective Measures:

   a. Review existing sewer system plans with the Engineer and Owner.

   b. Verify the size and location of connecting laterals and side sewers.

   c. Provide pumps with sufficient capacity and head.

   d. Provide standby redundant pumping equipment in place at both pump stations in the event of primary pump failure.

   e. Investigate upstream manholes for potential issues related to the bypass operation(s).

   f. Check and test pumping equipment and bypass system(s).

   g. Provide suitably experienced person(s) and training personnel (more than one individual) for operation and maintenance of the system(s), including dealing with emergencies.

   h. Check and monitor upstream and downstream manholes for surcharging after bypassing operations have commenced.

   i. Properly monitor and maintain system during operation.

5. Customer Sewer Service Interruption:

   a. The project may require interruption in sewer service for customers during construction. The Contractor shall notify the County Construction Manager and affected customer(s) not less than 2 working days in advance of service interruption and shall indicate the estimated length of time the service will be interrupted. Temporary sewer bypass systems for an individual customer or customers are not required provided the following conditions are met:

      1) Interruption in service shall be minimized and shall be limited to a maximum 6-hour period, to occur during the hours of 9 AM to 3 PM.

   b. The Contractor shall provide and bear all costs for temporary sewer bypass systems in accordance with this Section if the above conditions cannot be met, unless otherwise approved by the County Construction Manager.

6. Quality Assurance:

   a. Temporary sewer bypass systems shall be designed, stamped and signed by a registered professional engineer in the State of Washington. Engineer shall have demonstrated experience in the design of pumping systems of comparable size and complexity.

b. Before commencement of any bypassing operation, the Contractor shall obtain the Engineer's acceptance of the Bypass Plan including design, equipment and materials, installation, operation, and maintenance.

c. Temporary Bypass Qualifications: Contractor shall have a minimum of five years of experience in performing substantially similar temporary bypass operations and shall submit evidence of satisfactory operation of temporary bypass facilities similar to those specified for at least five projects in accordance with the Contract Specifications.

7. Sewer Bypass System Description:

a. Contractor shall provide all pumps, piping, and tanker trucks and be responsible for filling tanker trucks, hauling, and properly disposing of sewage. The Contractor shall schedule and conduct work in a manner that will minimize the number of times and length of time that temporary/bypass pumping is required.

b. All temporary piping, hoses, fittings, valves, and other appurtenances shall be fully restrained. Temporary bypass discharge piping shall be ductile iron (DI), HDPE or high-pressure discharge hose. Use of "lay-flat" style hose shall not be used without written approval of the Owner.

c. Contractor will be responsible for properly operating, protecting, maintaining, and servicing the bypass equipment for the duration of the temporary bypass. Contractor shall be responsible for bypass pumping equipment, electrical service, fuel, and all other appurtenances and consumables required for operation of the temporary sewer bypass system.

d. All bypass piping, fittings, and valves at Pump Station 19 shall be restrained. Use of bypass piping camlock style connections with retaining / lock pins at Pump Station 31 are acceptable. Use of Bauer style ball and socket connections shall not be allowed.

e. Noise levels of equipment shall meet the requirements of Kitsap County and Washington State noise level requirements. Depending on the pumping equipment that is used, meeting this requirement may require the use of sound attenuating enclosures as well as other provisions and measures. If possible, existing power supplies should be used to power the bypass pumping equipment so as to avoid engine-driven pumping units or engine generators. If engine-driven pumps or engine generators are used, equipment shall be located as far from residences as possible. Depending on the situation and subject to the approval of the Owner, the only possible exception or relaxation of this requirement will be in cases where the bypassing equipment will only be operated: 1) during the work week; 2) during normal working hours and 3) period of bypass operation will be less than one week.

f. The temporary sewer bypass system for each pump station shall be designed to handle the peak flows entering the station while maintaining adequate cleaning velocities (>3.5 fps) within the temporary piping as required. For Pump Stations 19 and 31, anticipated flow rates are as follows:

	Average Flows	Peak Flows
Pump Station 19 SSMH J18-3001 SSMH J18-3081 4″ SSFM	 250 gpm 35 gpm 145 gpm	 500 gpm 50 gpm 145 gpm
Pump Station 31	20 gpm	30 gpm

g. Maintain sufficient equipment, parts, materials, and fuel on-site to ensure continuous and uninterrupted operation of the bypass system(s). A minimum of 24-hours of fuel shall be maintained on-site. Standby pumps and generators shall be fueled and operational at all times. Contractor's personnel shall be knowledgeable and trained on how to operate and maintain the bypass equipment.

h. All monitoring shall be fully functional during bypassing.

i. If the bypass system is to be operated when the Contractor is not on-site, the system shall be provided with a monitoring and alarm system that notifies the Contractor and Owner 24 hours a day of a system failure. In the event of a failure, Contractor shall respond immediately and fix the cause of the problem. Contractor shall be on-call 24 hours a day and be able to respond within 30 minutes at all times during sewer bypassing. The Contractor will be required to demonstrate to the satisfaction of the Owner that this requirement can be met, and that responsible and appropriately trained personnel will be able to deal with emergencies that could arise. The Contractor is encouraged to consider retaining a company or individual(s) that specialize in the operation and maintenance of bypass sewer systems that require unattended operation.

j. Sewer bypassing shall not cause backup of sewage into residences or the upstream or downstream conveyance systems. Depth of surcharge upstream shall be kept to the minimum necessary. The Contractor will be responsible for repairing any damage to property due to surcharging of the system.

k. All sewer pipes and manholes that were surcharged shall be properly flushed to remove accumulated sewage material.

l. If damaged, restore bypass areas to pre-existing conditions in accordance with the requirements of the Contract Documents.

8. Spills:

   a. Contractor is fully responsible for any damage that may result from inadequate or improper installation, maintenance, operation, or failure of any kind of the bypass system. That responsibility includes but is not limited to the costs associated with cleanup and repair of property damage.

   b. Spills or bypasses of sewage to surface waters or drainage courses is prohibited. In the event of sewage spills, the Contractor shall immediately take action to stop the spill. Should the Contractor not take immediate action, the Owner will be entitled to take action to stop the spill.

   c. Costs incurred by the Contractor or Owner, including penalties imposed on the Owner as a result of any sewage spill caused by the Contractor, its employees, or subcontractors, shall be borne in full by the Contractor, including legal fees and other expenses to the Contractor or Owner resulting directly or indirectly from the spill.

9. Hydrostatic Testing of HDPE Force Mains

   a. Leak tests shall be conducted in accordance with ASTM F2164 and as specified herein. Sewer force mains shall be tested at a pressure 1.5 times the rated pressure of the pipe or the maximum pressure rating of the lowest pressure rated component in the test section, whichever is less. The test pressure shall be monitored at the lowest elevation point in the test section. The Contractor shall provide two weeks advance notice of hydrostatic testing.

   b. Pipe shall be completely backfilled prior to testing. Test sections shall be sealed with full pressure rated end closures such as metal blind flanges bolted to HDPE flange adapters. Provide proper blocking to restrain the pipe in place if necessary. Pressure testing against closed valves will not be permitted without prior approval of Engineer. All bolt-on connections shall be exposed for visual inspection during hydrostatic testing.

   c. Pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping and measuring equipment necessary for performing the test shall be furnished and operated by the Contractor.

   d. The Contractor shall furnish the water necessary to fill the pipelines for testing purposes at a time of day when sufficient quantities of water are available for normal system operation.

   e. Add make-up water as required to maintain the test pressure within 5% of the target test pressure for a period of four (4) hours. After this initial expansion and stabilization phase, reduce the pressure by 10 psi and begin the hydrostatic test. The pressure shall remain within 5% of the test pressure for a period of one (1) hour to indicate that there is no leakage.

f. Under no circumstances shall the total time for initial pressurization and time at the test pressure exceed eight (8) hours. If for some reason the test is not completed because of leakage, equipment failure, or any other reason, the test section shall be depressurized and allowed to relax for at least eight (8) hours before re-pressurization.

g. Correctly made fusion joints will exhibit no visible leakage. Any visible leakage from a joint shall be cause for rejection and the joint shall be removed and remade. Repairs will not be allowed.

h. The Contractor is responsible for proper disposal of the water and shall neutralize the chlorine in the water before it is discharged. The discharge shall be at a controlled rate that does not cause flooding or erosion of any surfaces. If necessary, Contractor shall provide erosion control measures in accordance with the Contract Documents and satisfactory to the Contracting Agency's Representative and regulating agency. The chlorinated water may also be discharged into the existing sewer system provided the discharge rate does not exceed 150 gpm.

10. Work and Assistance by Owner:

a. Operation of the existing pump station facilities, including those operations which may be necessary to facilitate the Contractor's work will be provided by the Owner.

b. For minor assistance and operations, the Contractor shall provide a minimum of 3 days advance notice to the Owner. When major assistance or the Contractor's work needs to be done during the low flow period, which will require coordination of more than one individual, or more than a few hours of one individual of the owner's personnel, Contractor shall provide a minimum of 14 days advance notice to the Owner.

c. The Contractor shall not at any time undertake to close off any lines or open valves or take any other action which would or might affect the operation of any part of the Owner's existing systems without first discussing it with the Engineer and/or Owner. Unless permission is specifically granted, the Owner or responsible utility will open and close valves.

END OF SECTION

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SECTION 02 41 00
DEMOLITION, CUTTING, AND PATCHING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Demolition, cutting, and patching of existing facilities where shown on Drawings, or as required to accommodate new work shown or specified.
2. Abandoning existing pipes, utilities, vaults, and structures.
3. Removing and disposing of demolished equipment, asphalt concrete, and other materials. The removed equipment and materials shall be properly disposed of at the Contractor's expense.
4. Cleaning, packaging, and loading salvaged items onto the Owner's trucks for removal by the Owner.

1.02 SUBMITTALS

A. See Section 1-06 of the WSDOT Division 1 Special Provisions for requirements for the mechanics and administration of the submittal process.

B. Demolition Schedule: Indicate overall schedule and interruptions impacting utility and facility services.

C. Indicate manufacturer and type of proposed materials and methods to be used for matching and repairing existing construction.

D. Indicate demolition and removal sequence, location of items designated for Owner's retention, and location and construction of temporary work.

1.03 QUALITY ASSURANCE

Conform to applicable codes and Operational Safety and Health Administration (OSHA) requirements for demolition work, dust control, products requiring electrical disconnection and reconnection, and mechanical system decommissioning.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Salvage designated items as a functional unit, including auxiliary or associated equipment required for operation.

B. Clean, list, and tag for storage.

C. Protect from damage and deliver to location designated.

1.05 PROJECT CONDITIONS

A. Perform preliminary investigations as required to ascertain extent of work.

B. Conduct demolition to minimize interference with adjacent areas.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate and reschedule work as required to preclude interference with other operations.

B. Do not remove or abandon existing sanitary sewer facilities until the new sanitary sewer systems or temporary pumping systems are fully operational, unless noted otherwise on the Drawings.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:

1. Non-shrink grout:
    a. Supreme Grout by Gifford Hill.
    b. Masterflow 713 Plus by BASF Building Systems.
    c. Sika Grout 212 by Sika.
    d. Five Star Grout by Five Star Products, Inc.
2. Epoxy bonding adhesive:
    a. Euco No.452 MV by Euclid Chemical Co.
    b. Sikadur 32, Hi-Mod by Sika Corporation.
3. Epoxy patch:
    a. Depth of patch:
        1) Greater than 3/4 IN: Five Star MP Epoxy Patch.
        2) Between 1/8 IN and 3/4 IN: Five Star Fluid Epoxy.

B. Submit request for substitution in accordance with Section 1-06 of the WSDOT Division 1 Special Provisions.

2.02 MATERIALS

A. NON-SHRINK GROUT

1. Non-metallic, non-corrosive, and non-staining.
2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
3. Grout to produce a positive but controlled expansion:
    a. Mass expansion not to be created by gas liberation or by other means.
4. Minimum compressive strength at 28 days to be 6500 psi.

5. Coat exposed edges of grout with a cure/seal compound recommended by grout manufacturer.

B. EPOXY BONDING ADHESIVE

1. Two component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.

C. CONTROLLED DENSITY FILL (CDF)

1. See Specification Section 31 23 33 – Trenching, Backfilling, and Compacting for Utilities for requirements for CDF.

PART 3 : EXECUTION

3.01 PREPARATION

A. Notify affected utility companies before starting work and comply with their requirements.

B. Mark location and termination of utilities.

C. Provide covered passageways where necessary to ensure safe passage of persons in or near areas of work.

D. Provide substantial barricades and safety lights as required.

E. Provide temporary dustproof partitions, where indicated or necessary.

F. Prevent infiltration of dust into occupied areas.

G. Provide temporary weather protection as necessary.

3.02 INSTALLATION

A. CUTTING AND REMOVAL

1. Remove existing work indicated to be removed, or as necessary for installation of new work.
2. Neatly cut and remove materials and prepare all openings to receive new work.

B. ABANDON STRUCTURES, MANHOLES, AND VAULTS

1. Remove equipment to be salvaged, reused, or disposed of.
2. Demolish structures, manholes, and vaults as shown on the Drawings.
3. Fill remaining structures with CDF, sand, or other material approved by the Engineer unless otherwise shown on the Drawings.
4. Backfill and compact excavated areas as shown on the Drawings.

C. ABANDON PIPE

1. Completely fill pipe to be abandoned with CDF by pumping CDF into the pipes. Cap pipes with concrete plugs, mechanical cap, or other method approved by the Engineer.

D. REMOVE PIPE

1. Where shown on the Drawings or at other locations as determined by the Construction Manager, cut and remove pipe in its entirety regardless of the size or type.
2. Backfill and compact voids left by pipe removal with suitable backfill material.
3. All removed materials shall become property of the Contractor and shall be properly disposed of outside the project limits.

E. Disconnect and abandon existing power and telephone in place in accordance with governing utility authority requirements, unless otherwise indicated on the Drawings.

F. Remove and salvage designated items as a functional unit, including auxiliary or associated equipment required for operation.

G. MODIFICATION OF EXISTING CONCRETE

1. Where indicated, remove existing concrete and finish remaining surfaces:
    a. Protect remaining concrete from damage.
    b. Make openings by sawing through the existing concrete.
    c. Break out concrete after initial saw cuts in the event concrete thickness prevents cutting through.
    d. Make openings by drilling holes around perimeter of opening and then chipping out the concrete where sawing is not possible:
        1) Holes shall be sufficient in number to prevent damage to remaining concrete.
2. Oversize required openings in existing concrete 1 IN on all sides and build back to required opening size by means of non-shrink grout epoxy bonded to the existing concrete.
3. Where oversized openings cannot be made, remove the concrete to the required opening size and cut back exposed reinforcing 1 IN from face of concrete and fill resulting holes with non-shrink grout.

H. REMOVAL OF EXISTING ANCHOR BOLTS OR OTHER PROTRUDING ELEMENTS

1. Remove all protruding elements to a depth of 1/4 IN from finished surface.
2. Fill voids with epoxy patch.

I. MATCHING AND PATCHING

1. Walls, ceilings, floors, or partitions:
    a. Repair abutting walls, ceilings, floors, or partitions disturbed by removal.
    b. Match and patch existing construction disturbed during installation of new work.
2. Methods and materials:
    a. Similar in appearance, and equal in quality to adjacent areas for areas or surfaces being repaired.
    b. Subject to review be the Owner.
3. Reinforcing steel that is cut and exposed:
    a. Remove to a depth of 1/4 IN.
    b. Fill void with epoxy patch.

J. SALVAGED ITEMS

1. Thoroughly dry and clean all metal surfaces.
2. Prime all bare metal in accordance with Section 09 96 00 – Painting and Protective Coatings.
3. Clean and lubricate motors and other moving parts.
4. Brace motors attached to flexible mountings until reinstallation.
5. Properly dispose of items or materials not designated for Owner's salvage or reuse:
    a. Promptly remove from site.
6. Do not store or sell Contractor salvaged items or materials on-site.
7. Carefully remove items to be salvaged or reused:
    a. Store and protect items indicated on the Drawings or those that have been marked by the Owner to be salvaged or to be reused in Work.
    b. Replace any item damaged through carelessness in removal, storage, or handling with new items of same type.
    c. Load salvaged items onto the Owner's trucks for removal by the Owner.
    d. Do not reuse materials or equipment not specifically indicated or specified to be reused.
8. Preparation of equipment for storage:
    a. Identify each component with markings or tags to show its position in the assembly and the assembly of which it belongs.
    b. Place small parts in wooden boxes and clearly mark contents on the outside.

c. Remove oil from oil-lubricated bearings and gear boxes and replace with storage oil.

d. Grease grease-lubricated bearings.

e. Replace any breather plug with solid plug.

f. Megger test motor windings: Attach report of the test results to the unit and furnish one (1) copy to the Owner.

g. Attach unit to suitable crate bottom.

h. Enclose unit in polyethylene film and seal all seams and the film to the base of the unit with tape.

i. Construct crate of wooden slats around top and sides of unit.

j. Attach a permanent instruction tag to the outside of the crate stating, "This unit has been prepared for storage--replace oil, vent plugs, and lubricant in accordance with the manufacturer's instructions before start-up."

K. CLEAN UP: transport debris and legally dispose of off-site.

3.03 ASPHALT AND CONCRETE REMOVAL AND REPLACEMENT

A. All concrete and asphalt requiring removal and replacement shall be neatly saw cut full depth prior to removal.

B. Debris resulting from the above operations shall be removed, hauled off-site, and disposed of at the Contractor’s expense.

3.04 GRAVEL SURFACED DRIVES AND ROADWAYS

The Contractor shall restore all damaged gravel surfaced drives and roadways to a condition equal to or better than the original condition.

3.05 TREES

Do not remove trees without written instructions from the Engineer, unless tree removal is shown on the Drawings.

3.06 FENCES, SIGNS, MAILBOXES, ETC.

Restore all damaged fences, signs, mailboxes, etc., to their original conditions.

3.07 SCHEDULE

Items to be salvaged to the Owner shall be as designated on the Drawings.

END OF SECTION

SECTION 03 00 00
CONCRETE GENERAL REQUIREMENTS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes: General requirements and quality assurance provisions for all cast-in-place concrete.

B. Related Specification sections include but are not necessarily limited to:

1. Section 03 11 00 – Concrete Formwork.
2. Section 03 15 00 – Concrete Accessories.
3. Section 03 15 10 – Openings and Penetrations in Construction.
4. Section 03 20 00 – Concrete Reinforcement.
5. Section 03 30 00 – Cast-in-Place Concrete.
6. Section 03 31 10 – Concrete Mixtures.
7. Section 03 31 11 – Cold Weather Concreting.
8. Section 03 31 12 – Hot Weather Concreting.
9. Section 03 60 00 – Grout.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

B. DEFINITIONS

1. Abbreviations for organizations issuing documents referred to in the specifications are listed below:

AASHTO	American Association of State Highway and Transportation Officials
WSDOT	Washington State Department of Transportation
ACI	American Concrete Institute
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CRSI	Concrete Reinforcing Steel Institute
ICC	International Code Council
NSF	National Sanitation Foundation
PTI	Post-Tensioning Institute

2. Architectural concrete: Concrete that is exposed as an interior or exterior surface in the completed structure and is designated as architectural concrete in the Contract Documents; contributes to visual character of the completed structure and therefore requires special care in the selection of the concrete materials, forming, placing, and finishing to obtain the desired architectural appearance.

3. Backshores: Shores placed snugly under a concrete slab or structural member after the original framework and shores have been removed from a small area at a time, without allowing the slab or member to deflect, or support its own weight or existing construction loads from above.

4. Cement, expansive: A cement that, when mixed with water, produces a paste that, after setting, tends to increase in volume to a significantly greater degree than does Portland cement paste; used to compensate for volume decrease due to shrinkage or to induce tensile stress in reinforcement.

5. Cement, expansive Type K: A mixture of Portland cement, anhydrous tetracalcium trialuminate sulfate (C_4A_3S), calcium sulfate ($CaSO_4$), and lime (CaO); the C_4A_3S is a constituent of a separately burned clinker that is interground with Portland cement, or alternatively, is formed simultaneously with the Portland-cement clinker compounds during the burning process.

6. Duct: A conduit (plain or corrugated) to accommodate prestressing steel for post-tensioned concrete.

7. Exposed to public view: Situated so that it can be seen from a public location after completion of the building.

8. High early strength concrete: Concrete which, through the use of high early strength cement or admixtures, is capable of attaining specified strength at an earlier age than normal concrete.

9. Lightweight concrete: Concrete of substantially lower unit weight than concrete made using gravel or crushed stone aggregates.

10. Mass concrete: Any volume of concrete with dimensions large enough to require that measures be taken to cope with generation of heat from hydration of the cement and attendant volume change to minimize cracking.

11. Mass concrete, plain: Mass concrete containing no reinforcement or less reinforcement than necessary to be considered reinforced mass concrete.

12. Mass concrete, reinforced: Mass concrete containing adequate reinforcement, prestressed or non-prestressed, designed to act together with the concrete in resisting all forces, including those induced by temperature and shrinkage.

13. Normal weight concrete: Concrete having a unit weight of approximately 150 pounds per cubic foot made with gravel or crushed stone aggregates.

14. Post-tensioning: A method of prestressing reinforced concrete in which tendons are tensioned after the concrete has hardened.

15. Prestressed concrete: Concrete where internal stresses of such magnitude and distribution are introduced that the tensile stresses resulting from the service loads are counteracted to a desired degree; in reinforced concrete, the prestressing is commonly introduced by tensioning tendons.

16. Reference standards: Standards of a technical society, organization, or association, including the codes of local or state authorities, which are referenced in the Contract Documents.

17. Reshores: Shores placed snugly under a stripped concrete slab or other structural member after the original forms and shores have been removed from a large area, thus requiring the new slab or structural member to deflect and support its own weight and existing construction loads applied before the installation of the reshores.

18. Sheathing, prestressing: A material encasing prestressing steel to prevent bonding of the prestressing steel with the surrounding concrete, to provide corrosion protection, and to contain the corrosion-inhibiting coating.

19. Sheathing, wood formwork: The materials forming the contact face of forms; also called lagging or sheeting.

20. Shore: A temporary support designed to support formwork, fresh concrete, and construction loads from above for recently built structures that have not developed full design strength.

21. Shrinkage-compensating concrete: A concrete made using an expansive cement that increases in volume after setting, designed to induce compressive stresses in elastically restrained concrete to approximately offset the tensile stresses resulting from drying shrinkage.

22. Strength test: The average of the compressive strengths of two or more 6” diameter x 12” cylinders, or 3 or more 4” diameter x 8” cylinders, made from the same sample of concrete and tested at 28 days or at test age designated for determination of f_C'.

23. Structural lightweight concrete: Structural concrete made with lightweight aggregate; the unit weight usually is in the range of 90 to 115 lb/ft^3.

24. Submitted: Submitted to the Engineer for review and acceptance.

25. WORK: The entire construction or separately identifiable parts thereof which are required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor, and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

1.03 QUALITY ASSURANCE

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

1. ACI STANDARDS

a.	ACI 117	Specifications for Tolerances for Concrete Construction and Materials
b.	ACI 423.6	Specification for Unbonded Single-Strand Tendons

2. ASTM STANDARDS

a.	A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
b.	A416	Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete
c.	A421	Standard Specification for Stress-Relieved Steel Wire for Prestressed Concrete
d.	A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
e.	A706	Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
f.	A722	Standard Specification for High-Strength Steel Bars for Prestressed Concrete
g.	A767	Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
h.	A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
i.	A779	Standard Specification for Steel Strand, Seven-Wire, Uncoated, Compacted for Prestressed Concrete
j.	A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
k.	A882	Standard Specification for Filled Epoxy-Coated Seven-Wire Prestressing Steel Strand
l.	A884	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
m.	A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
n.	A955	Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement
o.	A970	Standard Specification for Headed Steel Bars for Concrete Reinforcement
p.	A996	Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
q.	A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

r.	C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
s.	C33	Standard Specification for Concrete Aggregates
t.	C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
u.	C42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
v.	C94	Standard Specification for Ready-Mixed Concrete
w.	C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
x.	C143	Standard Test Method for Slump of Hydraulic-Cement Concrete
y.	C150	Standard Specification for Portland Cement
z.	C156	Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete
aa.	C157	Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
bb.	C171	Standard Specification for Sheet Materials for Curing Concrete
cc.	C172	Standard Practice for Sampling Freshly Mixed Concrete
dd.	C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ee.	C192	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ff.	C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
gg.	C260	Standard Specification for Air-Entraining Admixtures for Concrete
hh.	C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ii.	C330	Standard Specification for Lightweight Aggregates for Structural Concrete
jj.	C387	Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar
kk.	C404	Standard Specification for Aggregates for Masonry Grout
ll.	C494	Standard Specification for Chemical Admixtures for Concrete

mm.	C567	Standard Test Method for Determining Density of Structural Lightweight Concrete
nn.	C595	Standard Specification for Blended Hydraulic Cements
oo.	C597	Standard Test method for Pulse Velocity Through Concrete
pp.	C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
qq.	C685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
rr.	C803	Standard Test Method for Penetration Resistance of Hardened Concrete
ss.	C805	Standard Test Method for Rebound Number of Hardened Concrete
tt.	C845	Standard Specification for Expansive Hydraulic Cement
uu.	C873	Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds
vv.	C878	Standard Test Method for Restrained Expansion of Shrinkage-Compensating Concrete
ww.	C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
xx.	C900	Standard Test Method for Pullout Strength of Hardened Concrete
yy.	C920	Standard Specification for Elastomeric Joint Sealants
zz.	C928	Standard Specification for Packaged, Dry, Rapid Hardening Cementitious Materials for Concrete Repairs
aaa.	C939	Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
bbb.	C989	Standard Specification for Slag Cement for Use in Concrete and Mortars
ccc.	C1012	Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
ddd.	C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
eee.	C1059	Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
fff.	C1064	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

ggg.	C1074	Standard Practice for Estimating Concrete Strength by the Maturity Method
hhh.	C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
iii.	C1107	Standard Specification for Packaged, Dry, Hydraulic Cement Grout (Nonshrink)
jjj.	C1157	Standard Performance Specification for Hydraulic Cement
kkk.	C1218	Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
lll.	C1240	Standard Specification for Silica Fume Used in Cementitious Mixtures
mmm.	C1315	Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
nnn.	C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ooo.	D98	Standard Specification for Calcium Chloride
ppp.	D994	Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
qqq.	D1621	Standard Test Methods for Comprehensive Properties of Rigid Cellular Plastics
rrr.	D1751	Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types)
sss.	D1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ttt.	D3575	Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers
uuu.	E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
vvv.	E1155	Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers

3. OTHER REFERENCED STANDARDS

a.	AWS D1.4	Structural Welding Code-Reinforcing Steel
b.	CRD C513	Corps of Engineers - Specification for Rubber Waterstops

c. CRD C572 Corps of Engineers - Specification for Polyvinyl-Chloride Waterstop

d. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, 2020

4. CITED PUBLICATIONS

a. ACI 318 Building Code Requirements for Structural Concrete and Commentary

b. ACI CP1 Technician Workbook for ACI Certification of Concrete Field Testing Technician--Grade I

c. ACI CP10 Craftsman Workbook for ACI Certification of Concrete Flatwork Technician/Finisher

d. ACI SP Manual of Concrete Inspection

e. CRSI MSP Manual of Standard Practice

f. NSF Standard 61 Drinking Water System Components – Health Effects

B. GENERAL: Concrete materials and operations will be tested and inspected by the Owner as Work progresses. Failure to detect defective work or material shall not prevent rejection later when a defect is discovered nor shall it obligate Engineer for final acceptance.

C. TESTING RESPONSIBILITIES OF CONTRACTOR

1. Duties and Responsibilities. Unless otherwise specified in the Contract Documents, the Contractor shall assume the following duties and responsibilities:

a. Qualify proposed materials and establish mixture proportions.

b. Qualify proposed batching equipment and operators per Section 03 31 10 – Concrete Mixtures.

c. Furnish any necessary labor to assist Owner's testing agency in obtaining and handling samples at the project site or at the source of materials.

d. Notify Owner's testing agency at least 48 hours in advance of operations to allow for completion of quality tests and for assignment of personnel.

e. Provide and maintain adequate facilities for safe storage and proper curing of concrete test specimens on the job site for initial curing as required by ASTM C31 for the sole use of the testing agency.

f. Submit data and test documentation on materials and mixture proportions.

g. Submit quality control program of the concrete supplier and provide copies of all test reports.

h. When it is necessary to base concrete acceptance on accelerated strength testing, submit a request to use accelerated testing along with correlation data for the standard 28-day compressive strength based on at least 15 sets of test data in accordance with 1.03.G with concrete made with the same materials providing a range of at least f'_{cr} plus or minus 1000 psi.

D. TESTS REQUIRED OF CONTRACTOR'S TESTING AGENCY: Unless otherwise specified in the Contract Documents, Contractor shall provide at no cost to Owner the necessary testing services for the following:

1. Qualification of proposed materials and establishment of design mixtures.
2. Other testing services needed or required by Contractor.

E. TESTING RESPONSIBILITIES OF OWNER

1. Unless otherwise specified in the Contract Documents, the Owner, or Owner's Testing Agency will provide the necessary services for the following:
   a. Representatives of the Owner will inspect, sample, and test materials and production of concrete required by the Engineer. When it appears that material furnished or work performed by contractor fails to conform to Contract Documents, the Representative will immediately report such deficiency to the Owner, Engineer, Contractor, and concrete supplier
   b. Owner's Representative for testing shall report all test and inspection results to Owner, Engineer, Contractor, and concrete supplier within seven days after tests and inspections are performed.
2. Other Testing Services as Needed. The Contractor shall pay the expenses for testing services resulting from the following:
   a. Additional testing and inspection required because of changes in materials or mixture proportions requested by the Contractor.
   b. Additional testing of materials or concrete occasioned by failure to meet specification requirements.

F. TESTS ON HARDENED CONCRETE IN PLACE

1. General. Tests on hardened concrete will be performed by the Owner's testing agency when such tests are needed. Testing and core filling shall be at the Contractor's expense when tests are performed to verify the strength of the structure when required by this specification. Owner will pay costs if tests are at the owner's request and not required by this specification.
2. Non-Destructive Tests. Use of the rebound hammer in accordance with ASTM C805, pulse velocity methods in accordance with ASTM C597, or other non-destructive devices may be permitted by the Engineer in evaluating the uniformity and relative concrete strength in place, or for selecting areas to be cored.

3. Core Tests.

   a. Where required by the Engineer, cores shall be obtained and tested in accordance with ASTM C42. Wipe cores surface-dry immediately after coring and allow to dry in air for a period not exceeding one hour after drilling. Seal cores in plastic bags or nonabsorbent containers until testing. End preparation of cores shall be completed within 48 hours after drilling. Test cores not earlier than 48 hours after drilling or last wetting and not later than seven days after the cores were drilled form the structure.

   b. At least three representative cores shall be taken from each area of in-place concrete that is considered potentially deficient. The location of cores as determined by the Engineer shall impair the strength of the structure as little as possible. If, before testing, cores show evidence of having been damaged subsequent to or during removal from the structure, replacement cores shall be taken.

   c. Fill core holes with low slump concrete or mortar of a strength equal to or greater than the original concrete.

G. ACCEPTANCE OF CONCRETE STRENGTH

1. Standard Molded and Cured Strength Specimens. The strength level of concrete will be considered satisfactory when the averages of all sets of three consecutive compressive strength test results, molded and cured in accordance with ASTM C31, equal or exceed the specified compressive strength fc′ and no individual strength test result falls below the specified compressive strength fc′ by more than 500 psi when fc′ is 5000 psi or less, or by more than 0.10 fc′ when fc′ is more than 5000 psi. These criteria apply also when accelerated strength testing is specified unless another basis for acceptance is specified in the Contract Documents.

2. Nondestructive Tests. Nondestructive tests shall not be used as the sole basis for accepting or rejecting concrete but may be used when permitted to evaluate concrete where standard molded and cured cylinders have yielded results not meeting the criteria in 1.03.G.

3. Core Tests. Strength level of concrete in the area represented by core tests will be considered adequate when the average compressive strength of the cores are equal to at least 85 percent of specified compressive strength fc′, and if no single core is less than 75 percent of the specified compressive strength fc′.

H. FIELD ACCEPTANCE OF CONCRETE

1. Air Content. Concrete not within the limits of air entrainment indicated in Specification Section 03 31 10 – Concrete Mixtures, and tested in accordance with Section 03 31 10, 2.02.D shall not be used in the Work.

2. Slump. Concrete not within the slump limits of specification Section 03 31 10 – Concrete Mixtures, at the point of placement shall not be used in the Work.

3. Temperature. Concrete not within temperature limits of Specification Section 03 31 10 – Concrete Mixtures, shall not be used in the Work.

1.04 ACCEPTANCE OF STRUCTURE

A. GENERAL: Completed concrete work shall conform to applicable requirements of this Specification and the Contract Documents.

1. Concrete work that fails to meet one or more requirements of the Contract Documents but subsequently is repaired to bring the concrete into compliance may be accepted.
2. Concrete work that fails to meet one or more requirements of the Contract Documents and cannot be brought into compliance will be rejected.
3. Repair rejected concrete work by removing and replacing or by reinforcing with additional construction required by the Engineer. To bring rejected work into compliance, use repair methods that will maintain specified strength and meet all applicable requirements for function, durability, dimensional tolerances, and appearance as determined by the Engineer.
4. Submit for acceptance the proposed repair methods, materials, and modifications needed to assure that concrete work will meet requirements of Contract Documents.
5. Contractor shall pay all costs to bring concrete work into compliance with requirements of the specification.
6. Concrete members cast in the wrong location may be rejected.

B. DIMENSIONAL TOLERANCES

1. Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of ACI 117, may be considered deficient in strength and subject to the provisions of 1.04.D, Strength of Structure.
2. Formed surfaces resulting in concrete outlines larger than permitted by ACI 117 may be rejected. Excess materials will be subject to removal when required by the Engineer.
3. Inaccurately formed concrete surfaces that exceed ACI 117 tolerances may be rejected.
4. Finished slabs exceeding the tolerances in Specification Section 03 30 00 – Cast-in-Place Concrete, may be corrected provided they are brought into compliance with 1.04.C, 1.04.D, and 1.04.E below.
5. Concrete with tolerances and defects exceeding the limitations of Specification Section 03 11 00 – Concrete Formwork, will be rejected.

C. APPEARANCE

Concrete not meeting the requirements of Specification Section 03 30 00 – Cast-in-Place Concrete, Paragraph 3.03 or 3.04 (finishing of formed and finishing unformed surfaces) shall be brought into compliance in accordance with Paragraph 3.07 of Section 03 30 00.

D. STRENGTH OF STRUCTURE

1. Criteria for Determining Potential Strength Deficiency. Strength will be considered deficient and concrete will be rejected when the Work fails to comply with requirements which control the strength of the structure, including but not limited to the following conditions:

   a. Concrete strength failing to comply with requirements of 1.03.G, Acceptance of Concrete Strength.

   b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the requirements of Specification Section 03 20 00 – Concrete Reinforcement, or other Contract Document Requirements.

   c. Concrete elements which differ from the required dimensions or location.

   d. Curing not in accordance with Contract Documents.

   e. Inadequate protection of concrete from extreme temperature and other environmental conditions during early stages of hardening and strength development.

   f. Mechanical injury, construction fires, accidents, or premature removal of formwork resulting in deficient strength.

2. Action Required When Strength is Potentially Deficient. When strength of the structure is considered potentially deficient, the following actions may be required by Engineer:

   a. Structural analysis, additional testing, or both.

   b. Core tests.

   c. If testing is inconclusive or impractical or if structural analysis does not confirm the safety of the structure, load tests may be required, and their results evaluated in accordance with ACI 318.

   d. Concrete work rejected by structural analysis or by results of a load test shall be reinforced with additional construction when required by Engineer or replaced.

   e. The Contractor shall document all repair work proposed to bring strength-deficient concrete work into compliance with Contract Documents and submit the documentation to Engineer for acceptance.

E. DURABILITY

1. Criteria for Determining Potential Durability Deficiency. Durability of concrete will be considered deficient and the concrete work will be rejected when it fails to comply with the requirements which control durability of the structure, including but not limited to the following conditions:

   a. Strength failing to comply with 1.03.G, Acceptance of Concrete Strength.

b. Materials for concrete not conforming to the requirements in Specification Section 03 31 10 – Concrete Mixtures.

c. Concrete not conforming to the air entrainment requirements in Contract Documents or the total air content limits of Specification Section 03 31 10 – Concrete Mixtures.

d. Curing not in accordance with Contract Documents.

e. Inadequate protection of concrete from detrimental temperature and other detrimental environmental conditions during early stages of hardening and strength development.

2. Action Required When Durability is Potentially Deficient. When durability of the structure is considered to be potentially deficient, the following actions may be required by the Engineer:

a. Obtain and test samples of the ingredient materials used in the concrete.

b. Obtain samples of concrete from the structure by coring, sawing, or other acceptable means.

c. Laboratory evaluation of concrete and concrete materials to assess the ability of concrete to resist weathering action, chemical attack, abrasion, or other deterioration, and to protect reinforcement and embedments from corrosion.

d. Repair or replace concrete rejected for durability deficiency as directed by Engineer.

e. Document repair work to bring concrete work into compliance with Contract Documents and submit the documentation to Engineer for acceptance.

1.05 PROTECTION OF IN-PLACE CONCRETE

A. LOADING AND SUPPORT OF CONCRETE: Do not allow construction loads to exceed the superimposed load which the structural member, with necessary supplemental support, is capable of carrying safely and without damage or unacceptable deflection.

B. PROTECTION FROM MECHANICAL INJURY: During the curing period, protect concrete from damaging mechanical disturbances, including load-induced stresses, shock, and harmful vibration. Protect concrete surfaces from damage by construction traffic, equipment, materials, rain or running water, and other adverse weather conditions.

1.06 PRECONCRETING CONFERENCE

A. A pre-concreting conference shall be held 5 to 10 working days before placing concrete to discuss construction procedures, personnel, and equipment to be used. Those attending shall include, at the direction of the engineer:

1. CONTRACTOR
    a. Project Manager, Superintendent, and all supervisors responsible for placement of reinforcement and concrete and construction of forms, and finishing and curing of concrete, including subcontractors, as applicable.
    b. Ready-mix supplier representative and batch plant operator
2. OWNER
    a. Project Manager/Resident Project Representative.
    b. Engineer.
    c. Testing lab representative and field special inspection personnel.

PART 2 : PRODUCTS

Not used.

PART 3 : EXECUTION

Not used.

END OF SECTION

SECTION 03 11 00
CONCRETE FORMWORK

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section covers design, construction and treatment of formwork to confine and shape concrete to the required dimensions.

B. Related Specification sections include but are not necessarily limited to:

1. Section 03 00 00 – Concrete General Requirements.
2. Section 03 15 00 – Concrete Accessories.
3. Section 03 15 10 – Openings and Penetrations in Construction.
4. Section 03 20 00 – Concrete Reinforcement.
5. Section 03 30 00 – Cast-in-Place Concrete.
6. Section 03 31 10 – Concrete Mixtures.
7. Section 03 31 11 – Cold Weather Concreting.
8. Section 03 31 12 – Hot Weather Concreting.
9. Section 03 60 00 – Grout.

1.02 STANDARDS AND CODES

Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1.03 SUBMITTALS

A. Submit under provisions of Division 1 as follows:

1. Submit the following project data unless otherwise specified:
   a. Formwork Release Agent. Submit data on formwork release agent proposed for use with each form surface to be used for acceptance.
   b. Shop Drawings. Submit shop drawings for formwork and formwork supports, sealed by a professional Engineer licensed in the state where the work will be done.
   c. Calculations for formwork, reshoring and backshoring, sealed by a professional Engineer licensed in the state where the work will be done.
   d. Manufacturer's data and samples of form ties.

e. Manufacturer's data and samples of expansion joint materials.

2. Submit the following data when required:

   a. Reshoring. When reshoring or backshoring is required or permitted, submit procedures and plans of operations, before use, sealed by a professional Engineer licensed in the state where work will be performed. Indicate on shop drawings the magnitude of construction loads permitted during reshoring or backshoring.

   b. Form Liners. Submit samples and catalog data for form liner material when specified.

3. Submit the following data when alternatives are proposed:

   a. Formwork Facing Materials. When formwork facing materials other than those specified are proposed for use, submit data for acceptance.

   b. Control Joints. If construction or control joints other than those indicated on Contract Drawings are desired, submit request for acceptance.

   c. Testing for Formwork Removal. When methods other than test of cylinders are proposed for determining time for formwork removal, submit data as specified in 3.04.B.

1.04 MATERIALS HANDLING

All materials and equipment shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability or appearance.

PART 2 : PRODUCTS

2.01 MATERIALS

A. FORM FACING MATERIALS

1. Materials for form faces in contact with concrete shall meet the requirements of Specification Section 03 30 00 – Cast-In-Place Concrete, paragraph 3.03.E, Unspecified Finishes, and the following requirements, unless otherwise specified in the Contract Documents.

   a. For Rough Form Finish. No form facing material is specified.

   b. For Smooth Form Finish. Use plywood, tempered concrete-form-grade hardboard, metal, plastic, paper or other acceptable materials capable of producing the desired finish for form-facing materials. Form facing materials shall produce a smooth, uniform texture on the concrete. Do not use form-facing materials with raised grain, torn surfaces, worn edges, patches, dents or other defects that will impair the texture of concrete surfaces. Furnish panels in largest practicable sizes to minimize number of joints.

B. FORM TIES

1. General

a. Provide factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.

b. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1 inch from the outer concrete surface. Provide form ties which will not leave a hole larger than 1-inch diameter in the concrete surface.

c. Provide tie cones at each end.

d. Ties shall positively secure the wall to the required dimension and hold the wall to that dimension prior to and during concrete placement.

e. The use of tie wires as form ties will not be permitted.

2. Snap Ties

a. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used.

b. Ties for liquid containment structures and walls below grade shall have a neoprene waterstop, factory applied at the center of the tie.

3. Taper Ties. Taper ties with plastic or rubber plugs of an approved and proven design may be used. The plugs shall be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the wall. At no time shall plugs be driven on the flat area outside the cylindrical recess. Plugs shall be A-58 Sure Plug as manufactured by Dayton Superior, or equal.

C. FORMWORK RELEASE AGENT

1. Use commercially manufactured form release agent that prevent formwork absorption of moisture, prevent bond with concrete, do not stain the concrete surfaces, and do not leave residual matter on surface of concrete or adversely affect proper bonding or subsequent application of other material applied to concrete surface.

2. For concrete surfaces of reservoirs, tanks, or channels used for conveyance, treatment or storage of water for eventual potable use, form release agents shall be listed in National Sanitation Foundation Standard 61, “Drinking Water System Components – Health Effects.”

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. Design and engineering of formwork and formwork supports shall be the responsibility of the Contractor. Designs of formwork and preparation of formwork drawings shall be under the supervision of a professional engineer licensed in the state where the work will be done.

B. Design formwork for construction loads, lateral pressure and requirements of the applicable building code, and for construction sequence shown on the Contract Drawings, if applicable. Design formwork to withstand the pressure resulting from placement and vibration of concrete and to maintain specified tolerances. The design assumptions for form pressure and rate of fill limitations for wall forms shall be stated on the formwork drawings. Wall forms shall be designed so wall sections can be poured full height between joints shown on the Contract Drawings without horizontal cold joints.

C. Do not use earth cuts as forms for vertical or sloping surfaces unless required or permitted by Contract Documents.

D. Maximum deflection of facing materials reflected on concrete surfaces exposed to view shall be $^{1}/_{240}$ of the span between structural members of the formwork, except for architectural concrete.

E. Locate and detail formed joints to the following requirements:

1. Locate and form construction joints that least impair strength of the structure and meet the requirements of Specification Section 03 30 00 – Cast-In-Place Concrete. In general, locate construction joints in the middle third of the spans of slabs, beams, and girders. When a beam intersects a girder within this region, offset the joint in the girder a distance equal to or greater than twice the width of the beam. Locate joints in walls and columns at the underside of floors, slabs, beams, or girders and at the top of footings or floor slabs. Make joints perpendicular to the main reinforcement. Any construction joints not shown on the Contract Drawings shall require the approval of the Engineer.
2. Provide keyways where indicated on Contract Drawings. Where longitudinal keyways are indicated on the Contract Drawings, make them a minimum of 1½-inch deep in joints in walls and between walls and slabs or footings.
3. Provide construction and contraction (control) joints where indicated on the Contract Documents. The location of control joints other than those indicated on the Contract Documents shall be submitted for acceptance.

F. For a smooth form finish, set the facing materials in an orderly and symmetrical arrangement, and keep the number of seams to a practical minimum. Support facing material with studs or other backing capable of maintaining deflections within the tolerances specified in 2.02.D.

2.03 FABRICATION AND MANUFACTURE

A. Formwork shall be tight to prevent loss of mortar from concrete. Provide watertight formwork when architectural concrete is specified.

B. Place ¾-inch-minimum chamfer strips in the corners of formwork to produce beveled edges on permanently exposed surfaces unless otherwise specified. Do not bevel reentrant corners or edges of formed joints of concrete unless otherwise specified in the Contract Documents.

C. Provide temporary openings at the base of the column and wall formwork and at other points where necessary to facilitate cleaning and inspection. Inspect formwork and remove deleterious material immediately before concrete is placed.

D. Fabricate embedded form ties so ends or end fasteners can be removed with minimum spalling at the faces of concrete.

After the ends or end fasteners of form ties have been removed, terminate the embedded portion of ties not less than 2 diameters, or twice the minimum cross-section dimension of the tie, from the formed concrete surface. In no case shall this distance be less than ¾ inch. Repair tie holes in accordance with Specification Section 03 30 00 – Cast-In-Place Concrete.

PART 3 : EXECUTION

3.01 CONSTRUCTION AND ERECTION OF FORMWORK

A. At construction joints, lap contact surface of the form sheathing for flush surfaces exposed to view over the hardened concrete in the previous placement.

1. Ensure formwork is held firmly against hardened concrete to prevent offsets or loss of mortar at construction joints and to maintain a true surface.

B. Unless otherwise specified in Contract Documents, construct formwork so concrete surfaces will conform to tolerance limits of ACI 117. The class of surface as given in ACI 117 shall be as follows:

1.	Walls, columns, and elevated slabs:	Class A
2.	Footings:	Class C

C. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in the formwork after concrete has taken its initial set. Brace formwork securely against lateral deflection and lateral instability.

D. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete. Set formwork and intermediate screed strips for slabs accurately to produce designated elevations and contours of the finished surface prior to removal of formwork. Ensure that edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds when the finish specified requires the use of such equipment.

E. When formwork is cambered, set screeds to a like camber to maintain required concrete thickness.

F. Fasten form wedges in place after final adjustment of forms and prior to concrete placement.

G. Anchor formwork to shores, supporting surfaces, or members to prevent upward or lateral movement of the formwork system during concrete placement.

H. The Contractor shall form for and leave all openings in the concrete work where required for the installation of his own work and/or for the work of others. He shall carefully examine all drawings for the need of such openings, and in failing to provide openings as shown on the drawings, he shall cut them at his own expense. Except as otherwise noted or specified, all such openings shall be filled with concrete, after the work to be installed therein has been completed. Construct formwork for wall openings to facilitate removal and to counteract swelling of wood formwork.

I. Provide runways for moving equipment and support runways directly on the formwork or structural member without resting on the reinforcing steel.

J. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for support of adjoining work prior to concrete placement.

K. Position and support expansion joint material other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.

L. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign material before concrete is placed.

M. Cover surfaces of formwork with an acceptable material that will prevent bond with the concrete. A field-applied formwork release agent or a factory-applied liner may be used. If a formwork release agent is used, apply to the surfaces of the formwork in accordance with the manufacturer's recommendations before placing reinforcing steel. Do not allow formwork release agent to puddle in the forms. Do not allow formwork release agent to contact reinforcing steel or hardened concrete against which fresh concrete is to be placed.

N. CLEANOUTS AND ACCESS PANELS

1. Temporary openings shall be provided at the bottom of the wall forms to facilitate cleaning and inspection prior to placing concrete.
2. Shavings, chips and all refuse shall be removed and the forms shall be broom-cleaned before any concrete is placed. Cleanout openings will not be permitted in exposed concrete without the Engineer's approval.

3.02 REMOVAL OF FORMWORK

A. When finishing is required, remove formwork as soon as removal operations will not damage concrete, subject to 3.04, Strength of Concrete Required for Removal of Formwork.

B. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform needed repairs or treatment required at once and follow immediately with specified curing.

C. Loosen wood formwork for wall openings when this can be accomplished without causing damage to concrete.

D. Do not damage concrete during removal of formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete. Perform needed repair and treatment required on vertical surfaces at once and follow immediately with specified curing.

E. Unless otherwise specified, leave formwork and shoring in place to support the weight of concrete in beams, slabs, and in-place structural members until concrete has reached f'_c, in accordance with 3.04. If a lower compressive strength is proposed for removal of formwork and shoring, submit detailed plans for review and acceptance. When shores and other vertical supports are arranged to allow the form-facing material to be removed without loosening or disturbing the shores and supports, the facing material may be removed at an earlier age unless otherwise specified.

F. FORM REMOVAL SAFETY

1. Forms shall be removed in a manner to ensure complete safety of the structure. In no case shall supporting forms or shoring of slabs or other suspended members be removed until members have acquired sufficient strength to support safely their weight and the load thereon.
2. Care shall be taken by the Contractor to assure that newly unsupported portions of the structure are not subjected to heavy construction or material loading. Additional shores or bracing shall be provided, as required to adequately support the members during the construction period.
3. All responsibility involved in the removal of forms, shores, and bracing shall rest with the Contractor, and he shall be solely responsible for accidents to persons and property of any nature.

G. All parts of removed forms, reserved for reuse shall be inspected, cleaned and repair. Any part or panel which has been dented, deformed or otherwise rendered unfit for reuse shall be discarded.

H. Tie-rod clamps to be entirely removed from the wall shall be loosened 24 hours after concrete is placed, and form ties may be removed at that time.

3.03 RESHORING AND BACKSHORING

A. When reshoring and backshoring is permitted or required, submit for acceptance a plan of reshoring and backshoring procedures and operations prior to their use.

B. While reshoring or backshoring are underway, do not permit any construction load on new construction.

C. During reshoring and backshoring, do not allow concrete in beam, slab, column, or any structural member to be loaded with combined dead and construction loads in excess of the loads permitted by Engineer for the concrete compressive strength at the time of reshoring or backshoring.

D. Place reshores and backshores in sequence with stripping operations.

E. Tighten reshores and backshores to carry the required loads without overstressing the concrete members. Leave them in place until tests required by 3.04, Strength of Concrete Required for Removal of Formwork, indicate that the concrete compressive strength has attained the minimum value specified in 3.02.E.

F. For floors supporting shores under newly placed concrete, either leave in place the original supporting shores or install reshores and backshores. The shoring system and the supporting slabs shall resist the anticipated loads. Locate reshores and backshores directly under a shore position or as indicated on formwork shop drawings.

G. In multi-story buildings, extend reshoring over a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction live loads.

3.04 STRENGTH OF CONCRETE REQUIRED FOR REMOVAL OF FORMWORK

A. When removal of formwork or reshoring is based on concrete reaching a specified compressive strength, concrete will be presumed to have reached this strength when test cylinders, field cured along with the concrete they represent, have reached the compressive strength specified for removal of formwork or reshoring. Mold cylinders in accordance with ASTM C31, and cure them under the same conditions for moisture and temperature as used for the concrete they represent. Test cylinders in accordance with ASTM C39. Contractor is responsible for casting cylinders and performing tests required to determine compressive strength necessary for form removal.

B. Alternatively, when specified or permitted, use of the following methods for evaluating concrete strength for formwork removal is permitted. Prior to using methods in 3.04.B.1 through 3.04.B.4, submit sufficient data using job materials to demonstrate correlation of measurements on the structure with the compressive strength of laboratory-cured molded cylinders or drilled cores. Correlation data for each alternative method for determining strength shall be submitted for acceptance.

1. Tests of cast-in-place cylinders in accordance with ASTM C873. This is limited to slabs with concrete depth from 5 to 12 inches.
2. Penetration resistance in accordance with ASTM C803.
3. Pullout strength in accordance with ASTM C900.
4. Maturity method in accordance with ASTM C1074.

C. MINIMUM STRIPPING TIME: Form removal for elevated slabs and beam or girder soffits shall be based on paragraph A or B, above, with required concrete compressive strength equal to the specified 28-day compressive strength, but in no case less than 7 days.

D. Form removal for columns, walls, and side forms of beams, girders, or footings shall be not less than 24 hours.

3.05 FIELD QUALITY CONTROL

A. Establish and maintain survey controls and benchmarks in an undisturbed condition until final completion and acceptance of the project.

B. Variations from plumb and designated building lines shall not exceed the tolerances specified in ACI 117.

3.06 INSTALLATION OF EMBEDDED ITEMS

A. GENERAL

1. The Contractor shall notify all trades when construction is ready for the setting of anchor bolts, inserts, sleeves, and other built-in equipment, in order that such material shall be set at the proper time. Before placing concrete, care shall be taken to determine that all items to be embedded in concrete are accurately located, firmly secured in place and protected from damage or displacement until securely held by the concrete.
2. All items shall be thoroughly cleaned, free from rust, scale, dirt, grease or other coating. Any wood used for removable keys shall be thoroughly dampened before concrete is placed against the wood. The Contractor shall be responsible for any displacement of the items caused by his workers.

B. Electrical conduit may be embedded in concrete, provided the following conditions are met. Conduit runs which cannot satisfy these conditions shall be done at the Contractor's expense.

1. Outside diameter of conduit shall not exceed $^1/_3$ of the concrete thickness.
2. Conduits shall not be placed closer than 3 conduit diameters on center.
3. Conduit shall not be embedded in structural concrete slabs less than 4 inches thick.
4. Only 2 conduits may cross at any point. The sum of the outside diameter of the crossing conduits shall not exceed $^1/_3$ of the concrete thickness.
5. A 1½-inch-minimum concrete cover shall be provided for conduits in structural concrete slabs.
6. Conduit shall not be located between bottom of reinforcing steel and bottom of concrete slab.
7. Conduit is generally not permitted in beams or girders.
8. Aluminum conduit shall not be embedded in concrete.
9. Reinforcing steel and/or post-tensioning ducts shall not be repositioned to clear conduit. Adjust conduit positions to clear reinforcement.

END OF SECTION

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SECTION 03 15 00
CONCRETE ACCESSORIES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. The work and materials specified in this section include concrete anchors and miscellaneous embedded items.

B. Related Specification sections include but are not necessarily limited to:

1. Section 03 00 00 – Concrete General Requirements.
2. Section 03 11 00 – Concrete Formwork.
3. Section 03 15 10 – Openings and Penetrations in Construction.
4. Section 03 20 00 – Concrete Reinforcement.
5. Section 03 30 00 – Cast-in-Place Concrete.
6. Section 03 31 10 – Concrete Mixtures.
7. Section 03 31 11 – Cold Weather Concreting.
8. Section 03 31 12 – Hot Weather Concreting.
9. Section 03 60 00 – Grout.

1.02 STANDARDS AND CODES

Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1.03 SUBMITTALS

A. In accordance with the provisions of WSDOT Division 1 Special Provisions, submit the following:

1. Catalog data for all items covered by this Section to be incorporated in the Work.

PART 2 : PRODUCTS

2.01 ANCHOR BOLTS

A. Anchor bolts shall be either post installed anchors or cast-in-place as shown on the Plans.

1. Post Installed anchors shall either be resin capsule, epoxy adhesive type or expansion type, torque-controlled, 316 stainless steel, Hilti, Powers, Rawl, Covert or approved equal. Hole diameter shall be 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 A, B, C, D, E, or F as required for the temperature of the concrete surface at the time of installation. Rapid setting epoxies shall not be used.
2. Post installed anchors shall be have a current International Code Council Evaluation Services ESR (ICC ESR) indicating the suitability for use in cracked concrete or masonry under seismic loading conditions and shall be of the diameter and embedment as required by the Plans or as required by Contractor's design calculations or as provided in other specification sections.
3. Adjustable anchors for equipment shall be floating nut-type which will allow at least ½ inch movement of the fastening stud. The fastening stud shall be 316 stainless steel. Adjustable anchors shall be DECO Manufacturing Co., Decatur Illinois, Standard Anchor or equal.
4. All expansion anchors shall be male-type projecting anchors, unless female-type anchors are specifically called out otherwise. Provide not less than minimum embedment depths where shown on the Contract Drawings, but in no case less than ICC ESR minimums for the size called out. Connected work shall not bear on threads.
5. Cast-in-place anchor bolts shall be as specified in Specification Section 05 50 00 – Metal Fabrications.

2.02 METAL FABRICATIONS

Reglets shall be as manufactured by Progress Unlimited, Inc., Heckman, or equal. Reglet shall be of rigid PVC plastic and accurately placed and free from grout to assure an acceptable channel to receive gasket.

2.03 PREFORMED JOINT FILLER

Preformed joint filler material shall be preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D1751, except as otherwise specified herein.

2.04 BACKER ROD

Backer rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a ¾-inch wide joint.

2.05 JOINT SEALANT

A. Joints shall be sealed with a mastic joint sealer material of uniform, stiff consistency that does not contain solvents.

B. The mastic shall tenaciously adhere to primed concrete surfaces, shall remain permanently mastic and shall not contaminate potable water.

C. The material shall be of a type that will effectively and permanently seal joints subject to movements in concrete.

D. The mastic joint sealer shall be an acceptable two-part, self-leveling (or gun grade), non-staining, polyurethane elastomeric sealant which cures at ambient temperature. Acceptable sealants shall conform to ASTM C920.

E. For sloping joints, vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ASTM C920 Class 12-1/2.

F. For plane horizontal joints, the self-leveling compounds which meet the requirements of ASTM C920 Class 25. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 25 to 35, shall be used.

G. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the sealant manufacturer.

H. Acceptable polyurethane materials are:

1. PSI-270 Reservoir Sealant, as manufactured by Polymeric Systems, INC., Phoenixville, PA (610-935-1170),
2. Sikaflex/-2C Polyurethane Elastomeric Sealant, as manufactured by SIKA CHEMICAL CORP., Santa Fe Springs, CA (310-941-0231)
3. Approved equal.

PART 3 : EXECUTION

3.01 ANCHOR BOLTS

A. NOTIFICATION: Owner’s representative shall be notified prior to placement of post installed anchors to check and verify anchor size and type, hole depth, preparation and placement.

B. INSTALLATION TOLERANCES: Anchor bolts shall be installed with the bolt perpendicular to the concrete surface, +/- 3 degrees. Bolts shall be installed not more than 1/16 inch from their design position measured perpendicular from the centerline of the bolt. Bolt projection from the concrete surface shall be not more than +/- ¼ inch form their design position for post installed anchors or cast-in-place anchor bolts.

C. DRILLED HOLES: Do not drill or install anchors until concrete has reached specified minimum 28-day compressive strength. Drilled holes for expansion or epoxy anchors shall be drilled using rotary driven twist drills of the size and type recommended by the anchor manufacturer. All holes shall be thoroughly cleaned before installation of anchors. Holes for epoxy anchors shall be dry, in accordance with installation instructions requirements of the ICC or other testing agency upon whose tests the bolt capacity is based.

D. LOCATION AND LENGTH: Minimum bolt embedment shall be 8 bolt diameters unless otherwise noted on the Contract Drawings. Do not install anchors closer than 6 inches to free edge of concrete, or closer than 12 bolt diameters to another anchor unless detailed on the Contract Drawings. Locate to clear reinforcing bars in concrete.

E. PRELOAD: All anchor bolts and anchors for connections to the building structure or large equipment with multiple-bolt base plates shall be preloaded. Cast-in-place anchors shall have bond breaker applied to the shank prior to installation to prevent load transfer to the concrete except at the bolt head or washer. Unless otherwise indicated on the Contract Drawings, all anchors shall be preloaded snug tight after installation. Snug tight shall be defined as with the full effort on a standard wrench to bring the base plate in firm contact with the substrate.

F. Nuts used to attach equipment or fixtures shall be tightened to not less than the manufacturer's recommended installation torque, or in the absence of specific recommendations, to the following torque values (foot-lbs).

Stud Diameter (inches)	Expansion Type Anchors (ft-lbs)	Resin or Cast-in-place Anchors (ft-lbs)
1 ¼	--	550
1	--	300
7/8	--	200
3/4	175	135
5/8	90	80
1/2	50	35
3/8	25	15
1/4	7	5

3.02 JOINT SEALERS

A. Joint sealed areas shall be sandblasted or roughened and blown clean of dust and sand with compressed air before the material may be applied.

B. Joints shall be primed (if required) and the sealant shall be applied in accordance with the manufacturer's recommendations.

END SECTION

SECTION 03 15 10
OPENINGS AND PENETRATIONS IN CONSTRUCTION

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes methods of installing and sealing openings and penetrations in construction.

B. Related Specification sections include but are not necessarily limited to:

1. Section 03 00 00 – Concrete General Requirements.
2. Section 03 11 00 – Concrete Formwork.
3. Section 03 15 00 – Concrete Accessories.
4. Section 03 20 00 – Concrete Reinforcement.
5. Section 03 30 00 – Cast-in-Place Concrete.
6. Section 03 31 10 – Concrete Mixtures.
7. Section 03 31 11 – Cold Weather Concreting.
8. Section 03 31 12 – Hot Weather Concreting.
9. Section 03 60 00 – Grout.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

1. ACI STANDARDS

a.	ACI 318	Building Code Requirements for Structural Concrete and Commentary

2. ASTM STANDARDS

a.	A36	Standard Specification for Carbon Structural Steel.
b.	A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. National Fire Protection Association (NFPA):

a.	NFPA 70	National Electrical Code (NEC): Article 501, Class 1 Locations.
b.	NFPA 90A	Standard for Installation of Air Conditioning and Ventilating Systems.

B. Obtain prior approval from Engineer when any opening larger than 100 square inches must be made in existing or newly completed construction.

1.03 DEFINITIONS

A. HAZARDOUS AREAS: Areas shown in the Contract Documents as having Class I or Class II area classifications.

B. WASHDOWN AREAS: Areas having floor drains or hose bibs.

1.04 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. For each structure provide dimensioned or scaled (minimum 1/8 inch = 1 FT) plan view drawings containing the following information:
    a. Vertical and horizontal location of all required openings and penetrations.
    b. Size of all openings and penetrations.
    c. Opening type.
    d. Seal type.
2. Manufacturer's installation instructions for standard manufactured products.

1.05 SITE CONDITIONS

Refer to the Geotechnical Report for the water table levels used for this Site.

PART 2 : PRODUCTS

2.01 MATERIALS

A. PIPE PENETRATIONS IN MANHOLES AND VAULTS: Conform to Specification Section 33 05 16 – Utility Structures.

B. PIPE SLEEVES: Steel, ASTM A53, Schedule 40, hot dip galvanized.

C. PIPE SLEEVES PENETRATING INTO CORROSIVE AREAS: Stainless steel, 1/4-inch minimum thickness.

D. BACKING ROD AND SEALANT: See Specification Section 07 92 00 – Caulking and Sealants.

E. MODULAR MECHANICAL SEALS

1. Acceptable manufacturers: Link-Seal.
2. 304 stainless steel bolts, nuts and washers.

F. COMMERCIAL WALL CASTINGS

1. For unclassified areas both sides of penetration:
    a. Ductile iron, class equal to connecting piping system.
2. For wet/corrosive areas either side of penetration:
    a. Stainless steel, 304L.

PART 3 : EXECUTION

3.01 INSTALLATION AND APPLICATION

A. Perform HVAC penetrations in accordance with NFPA 90A.

B. Perform electrical penetrations in accordance with NFPA 70, Article 501.

C. Install sleeves and castings in accordance with ACI 301, Section 2.3.1.12.

D. Hot-dip galvanize in accordance with Specification Section 05 50 00 – Metal Fabrications or paint in accordance with Specification Section 09 91 13 – Building Exterior Painting or 09 91 23 – Building Interior Painting all steel sleeves installed.

E. When mechanical or electrical work cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit installation later:

1. Lay out chases, holes or other openings which must be provided in masonry, concrete or other work.

F. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 inches above finish floors:

1. In non-washdown areas, install sleeves with ends flush with finished surfaces.

G. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.

H. Do not cut into or core drill any beams, joists, or columns.

I. FIELD CUTTING AND CORING

1. Saw or core drill with non-impact type equipment.
2. Mark opening and drill small 3/4 inch or less holes through structure following opening outline.
3. Sawcut opening outline on both surfaces:
    a. Knock out within sawcuts using impact type equipment.
    b. Do not chip or spall face of surface to remain intact.
    c. Do not allow any overcut with saw kerf.

J. Where alterations are necessary or where new and old work join, restore adjacent surfaces to their condition existing prior to start of work.

K. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in concrete:

1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
2. For commercial castings, cast water stop/anchor with wall pipe.
3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
4. For fabricated units, diameter of plate or flange to be 4 inches larger than outside diameter of sleeve, pipe or ductwork.
5. For commercial castings, waterstop/anchor size to be manufacturer standard.
6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.

L. Where area is blocked out to receive sheet metal sleeve at later date:

1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially placed concrete and sleeve encasement concrete which is placed later:
   a. Size blockout based on sleeve size required plus 4 to 6 inches each side of sleeve for concrete encasement.
   b. Provide #4 dowels at 12 inch spacing along each side of blockout with minimum of two (2) dowels required per side.
2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all sides of blockout:
   a. Size blockout based on sleeve size required plus 2 to 4 inches each side of sleeve for concrete encasement.

M. For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.

N. Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.

O. Do not make duct or conduit penetrations below high-water levels when entering or leaving tankage, wet wells, or other water holding structures.

P. MODULAR MECHANICAL SEALS

1. Utilize one (1) seal for concrete thickness less than 8 inches and two (2) seals for concrete, 8 inches thick or greater.
2. Utilize two (2) seals for piping 16 inches diameter and larger if concrete thickness permits.
3. Install seals such that bolt heads are located on the most accessible side of the penetration.

Q. BACKER ROD AND SEALANT

1. Provide backer rod and sealant for modular mechanical seal applications:

   a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section covers materials, fabrication, placement and tolerances of reinforcement and reinforcement accessories.

B. Related Specification sections include but are not necessarily limited to:

1. Section 03 00 00 – Concrete General Requirements.
2. Section 03 11 00 – Concrete Formwork.
3. Section 03 15 00 – Concrete Accessories.
4. Section 03 15 10 – Openings and Penetrations in Construction.
5. Section 03 30 00 – Cast-in-Place Concrete.
6. Section 03 31 10 – Concrete Mixtures.
7. Section 03 31 11 – Cold Weather Concreting.
8. Section 03 31 12 – Hot Weather Concreting.
9. Section 03 60 00 – Grout.

1.02 STANDARDS AND CODES

Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Reinforcement. Submit manufacturer's certified test report.
2. Placing Drawings. Submit placing drawings showing fabrication dimensions and locations for placement of reinforcement and reinforcement supports.
3. Splices: Submit a list and request to use splices not indicated in Contract Documents.
4. Mechanical Splices. Submit request for the use of mechanical splices not shown on the Project Drawings.
5. Column Dowels. Submit requests to place column dowels without the use of templates.

6. Field Bending. Submit requests and procedures to field bend or straighten reinforcement partially embedded in concrete.

7. Certification. If epoxy coated bars are being furnished, submit copy of current CRSI Plant Certification Manual.

B. Submit the following data when required:

1. Welding. Submit description of reinforcement weld locations and welding procedures, when welding is permitted in accordance with 2.02.B.

2. Supports. If coated reinforcement is required, submit description of reinforcement supports not described in 3.02.D, Reinforcement Supports, and material for fastening coated reinforcement.

C. Submit the following data when alternatives are proposed:

1. Reinforcement Relocation. Submit request to relocate any reinforcement that exceeds placement tolerances.

2. Inspection and quality-control program of plants applying epoxy coating if proposed plant is not certified in accordance with the CRSI Certification Program.

1.04 MATERIALS DELIVERY, STORAGE AND HANDLING

A. Prevent bending, coating with earth, oil or other material, or otherwise damaging the reinforcement.

B. For handling coated reinforcement, use equipment having contact areas padded to avoid damaging the coating. Lift bundles of coated reinforcement at multiple pick-up points to prevent bar-to-bar abrasion from sags in the bundles. Do not drop or drag coated reinforcement. Store coated reinforcement on cribbing that will not damage the coating.

1.05 SUPPLEMENTAL REINFORCEMENT NOT SHOWN ON THE PLANS

PART 2 : PRODUCTS

2.01 MATERIALS

A. REINFORCING BARS: Bars used as reinforcement shall be deformed except spirals and welded wire fabric, which may be plain unless otherwise designated on the Contract Drawings. Reinforcement shall be grade 60 unless otherwise indicated on the Contract Drawings and shall conform to one of the following:

1. ASTM A615

2. ASTM A706

3. ASTM A970

B. COATED REINFORCING: Reinforcing bar coatings, when required, shall be zinc, as indicated on the Contract Drawings.

1. Zinc-coated (galvanized) reinforcement shall conform to ASTM A767. Supplementary requirements S1 and S2 shall apply when fabrication after galvanization includes cutting and bending. Supplementary requirement S2 shall apply when fabrication after galvanization includes only bending.

    a. Repair all coating damage due to shipping, handling and placing in accordance with ASTM A780.

    b. The maximum amount of repaired damaged areas shall not exceed 2 percent of the surface area in each linear foot of each bar.

2. Epoxy-coated reinforcement shall conform to ASTM A775. Repair damaged areas with patching material conforming to ASTM A775 and in accordance with the material manufacturer's recommendations.

    a. Repair all coating damage due to shipping, handling and placing.

    b. The maximum amount of repaired damaged areas shall not exceed 2 percent of the surface area in each linear foot of each bar.

    c. Fading of the coating color will not be cause for rejection of epoxy-coated reinforcing bars.

C. STAINLESS STEEL BARS: Stainless steel bars shall conform to ASTM A955.

D. BAR MATS: Use bar mats of the clipped type conforming to ASTM A184 assembled from one of the following combinations:

1. Bars conforming to ASTM A615, ASTM A 996, or ASTM A706.

2. Zinc-coated (galvanized) bars conforming to ASTM A767 and zinc-coated (galvanized) or non-metallic clips with any damage to coatings repaired in accordance with 2.01.B.1.

3. Epoxy-coated bars conforming to ASTM A775 and epoxy-coated or non-metallic clips with any damage coatings repaired in accordance with 2.01.B.2.

E. WIRE: Use plain or deformed wire as indicated on the Contract Drawings. Plain wire may be used for spirals.

1. Plain wire shall conform to ASTM A1064.

2. Deformed wire size D4 and larger shall conform to ASTM A1064.

3. Epoxy-coated wire shall conform to ASTM A884.

4. For wire with a specified yield strength fy exceeding 60,000 psi, fy shall correspond to a strain of 0.35 percent.

F. WELDED WIRE REINFORCEMENT: Use welded wire reinforcement specified in Contract Documents and conforming to one of the following specifications:

1. Plain Wire Fabric. ASTM A1064, with welded intersections spaced not farther apart than 12 inches in the direction of principal reinforcement.
2. Deformed Wire Fabric. ASTM A1064, with welded intersections spaced not farther than 16 inches in the direction of principal reinforcement.
3. Epoxy-coated welded wire fabric shall conform to ASTM A884.
4. For welded wire fabric with a specified yield strength f_y exceeding 60,000 psi, f_y shall correspond to a strain of 0.35 percent.

G. WIRE REINFORCEMENT SUPPORTS: Unless otherwise specified or permitted, use wire reinforcement supports complying with Class 1, maximum protection, or Class 2, moderate protection as indicated in the CRSI *Manual of Standard Practice,* Chapter 3.

H. COATED WIRE REINFORCEMENT SUPPORTS

1. Epoxy-Coated Reinforcement. Use wire reinforcement supports coated with dielectric material, including epoxy or other polymer, for a minimum distance of 2 inches from the point of contact with epoxy-coated reinforcement.
2. Zinc-Coated Reinforcement. Use galvanized wire reinforcement supports or wire reinforcement supports coated with dielectric material.

I. PRECAST CONCRETE REINFORCEMENT SUPPORTS: Precast concrete supports for supporting reinforcement shall not be less than 4 square inches having a compressive strength equal to or greater than the specified compressive strength of the concrete being placed.

J. ALL-PLASTIC BAR SUPPORTS: All-plastic bar supports may be used for horizontal and vertical reinforcing steel. They may have a snap-on action or other method of attachment. All-plastic supports shall be non-porous and chemically inert in concrete. All-plastic bar supports shall have rounded seatings so as not to punch holes in the formwork and shall not deform under load when subjected to normal temperatures encountered in use, nor shall they shatter or severely crack under impact loadings when used in cold weather.

1. All-plastic bar supports shall have at least 25% of their gross plane area perforated and shall not be placed closer than 12 inches apart along a bar.

K. TIE WIRE: No. 16 American Wire Gauge or heavier, black annealed per ASTM A1064.

2.02 FABRICATION

A. REINFORCEMENT: Bend all reinforcement cold unless heating is specifically authorized in the Contract Documents or by the Engineer. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.

B. WELDING

1. When welding of reinforcement is required or permitted, make all welds in conformance with ANSI/AWS D1.4. Do not weld crossing bars (tack welding) for assembly of reinforcement, supports, or embedded items.

2. After completing welds on zinc-coated (galvanized) or epoxy-coated reinforcement, repair coating damage in accordance with requirements of the ASTM Specifications identified in 2.01.B.1 or 2.01.B.2, respectively. Coat welds and steel splice members used to splice reinforcement with the same material used for repair of coating damage.

PART 3 : EXECUTION

3.01 PREPARATION

When concrete is placed, reinforcement shall be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided the minimum nominal dimensions, nominal weight and the minimum average height of deformations of a hand-wire-brushed test specimen are not less than the applicable ASTM specification requirements.

3.02 PLACEMENT

A. TOLERANCES: Place, support, and fasten reinforcement as shown on the Contract Drawings. Do not exceed the placing tolerances specified in ACI 117 before concrete is placed. Placing tolerances shall not reduce cover requirements except as specified in ACI 117.

B. REINFORCEMENT RELOCATION: When necessary to move reinforcement beyond the specified placing tolerances to avoid interference with other reinforcement, conduits, or embedded items, submit the resulting arrangement of reinforcement for acceptance.

C. CONCRETE COVER: Minimum concrete cover for reinforcement, unless otherwise indicated in the Contract Drawings, shall be as indicated below:

Slabs & Joists	**Minimum Cover**
Top & bottom bars for dry conditions	
11 bars and smaller	¾ inches
#14 and #18 bars	1½ inches
Exposed Formed Concrete Surfaces*	
#5 bars and smaller, W31 or D31 wire and smaller	1½ inches
#6 through #18 bars, W45 or D45 wire	2 inches

Beams & Columns, formed	**Minimum Cover**
Dry conditions	
Stirrups, spirals, and ties	1½ inches
Principal reinforcement	2 inches
Exposed to earth, water, sewage, or weather	
Stirrups, spirals, and ties	2 inches
Principal reinforcement	2½ inches

Walls	**Minimum Cover**
For dry conditions	
#11 bars and smaller	¾ inches
#14 and #18 bars	1½ inches
Exposed Formed Concrete Surfaces**	2 inches

Footings and Base Slabs	**Minimum Cover**
At formed surfaces and bottoms bearing on concrete work mat	2 inches
At unformed surfaces and bottoms in contact with earth	3 inches
Top of footings	same as slabs
Over top of piles	2 inches

* Applicable to formed concrete surfaces exposed to earth, water, or weather, and over or in contact with sewage and for bottoms bearing on work mat, or slabs supporting earth cover.

** Applicable to formed concrete surfaces exposed to earth, water, sewage, weather, or in contact with ground.

1. For bundled bars, minimum concrete cover shall be equal to the equivalent diameter of the bundle but need not be greater than 2 inches, except the minimum cover shall not be less than specified above. The equivalent diameter of the bundle shall be based on a single bar of a diameter derived from the equivalent total area.

2. Tolerances on minimum concrete cover shall meet the requirements of ACI 117.

D. REINFORCEMENT SUPPORTS: Size and spacing of reinforcement supports shall conform to the CRSI *Manual of Standard Practice.* Reinforcement shown on the Contract Drawings shall not be relocated to serve as bolsters for other bars. The Contractor shall provide additional bars if necessary, to support the reinforcement shown on the Contract Drawings.

1. Horizontal bars in slabs and beams shall be supported at intervals not greater than 48 inches.

2. Wall and column reinforcement shall be laterally supported by side form spacers or other means at intervals not greater than 48 inches horizontally or vertically in the case of walls, and not greater than 48 inches vertically and at not less than 90-degree intervals in the case of columns.

3. Unless otherwise reviewed by the Engineer, use the following reinforcement supports:

    a. Place reinforcement supported from the ground or mud on precast concrete reinforcement supports.

    b. Place non-coated reinforcement supported from formwork on reinforcement supports made of concrete, metal, or plastic.

    c. Place zinc-coated (galvanized) reinforcement supported from formwork on wire reinforcement supports, which are galvanized, coated with dielectric material, or made of dielectric material.

    d. Reinforcement and embedded steel items used with zinc-coated (galvanized) reinforcement shall be zinc-coated (galvanized) or coated with non-metal materials.

    e. Place epoxy-coated reinforcement supported from formwork on coated wire reinforcement supports, or on reinforcement supports made of dielectric material. Coatings or materials shall be compatible with concrete.

    f. When precast reinforcement supports with embedded tie wires or dowels are used with epoxy-coated reinforcement, wires, or dowels shall be coated with dielectric material.

    g. Reinforcement used as supports with epoxy-coated reinforcement shall be epoxy-coated.

    h. In walls reinforced with epoxy-coated reinforcement, spreader bars shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcement shall be made of corrosion-resistant material or coated with dielectric material.

    i. Fasten epoxy-coated reinforcement with tie wires coated with epoxy or other polymer.

E. WELDED WIRE REINFORCEMENT: For slabs on grade, extend welded wire reinforcement to within 2 inches of the concrete edge. Lap edges and ends of welded wire reinforcement sheets a minimum of one-mesh spacing. Welded wire reinforcement may extend through contraction joints only where permitted. Support welded wire reinforcement during placing of concrete to assure required positioning in the slab. Do not place welded wire reinforcement on grade and subsequently raise into position in concrete.

F. COLUMN DOWELS: Furnish and use templates for placement of column dowels unless otherwise permitted.

G. Make splices as indicated on the Contract Drawings unless otherwise reviewed by the Engineer. Mechanical splices for reinforcement not shown on the Contract Drawings may be used only when accepted by the Engineer. Reinforcement coating shall be removed in the area of the mechanical splice if required by the splice manufacturer. After installing mechanical splices on zinc-coated (galvanized) or epoxy-coated reinforcement, repair coating damage and areas of removed coating in accordance with requirements of the ASTM Specifications identified in 2.01.B.1 and 2.01.B.2. Coat exposed parts of mechanical splices used on coated bars with the same material used for repair of coating damage.

H. FIELD BENDING OR STRAIGHTENING: When permitted, bend or straighten reinforcement partially embedded in concrete in accordance with the following procedures.

1. Reinforcing bar sizes No. 3 through No. 5 may be bent cold the first time provided reinforcing bar temperature is above 32ºF. For other bar sizes, preheat reinforcing bars before bending.

2. Preheating. Apply heat by any method which does not harm the reinforcing bar material or cause damage to the concrete. Preheat a length of reinforcing bar equal to at least 5 bar diameters in each direction from the center of the bend, but do not extend preheating below the surface of the concrete. Do not allow the temperature of the reinforcing bar at the concrete interface to exceed 500ºF.

   a. The preheat temperature of the reinforcing bar shall be 1100 to 1200ºF.

   b. Maintain the preheat temperature until bending or straightening is complete.

   c. Measure the preheat temperature by temperature measurement crayons, contact pryometer, or other acceptable method.

   d. Do not artificially cool heated reinforcing bars until the temperature of the bar is less than 600ºF.

3. Bend Diameters. Minimum inside bend diameters shall conform to the requirements of the table below unless otherwise permitted. In addition, beginning of the bend shall not be closer to the concrete surface than the minimum diameter of bend.

Bar Size	Minimum Inside Bend Diameter
#3 through #8	6 bar diameters
#9, #10 and #11	8 bar diameters
#14 and #18	10 bar diameters

4. Repair of Bar Coatings. After field bending or straightening zinc-coated (galvanized) or epoxy-coated reinforcing bars, repair coating damage with 2.01.B.1 or 2.01.B.2.

I. FIELD CUTTING OF REINFORCEMENT: Reinforcement shall not be cut in the field except when specifically permitted.

1. When zinc-coated (galvanized) reinforcing bars are cut in the field, coat the ends of the bars with a zinc-rich formulation used in accordance with the manufacturer's recommendations, and repair any coating damage in accordance with requirements of the ASTM Specifications identified in 2.01.B.1.

2. When epoxy-coated reinforcing bars are cut in the field, coat the ends of the bars with the same material used for repair of coating damage, and repair any coating damage in accordance with requirements of the ASTM Specifications identified in 2.01.B.2.

J. REINFORCEMENT THROUGH EXPANSION JOINT: Do not continue reinforcement or other embedded metal items bonded to concrete through expansion joints. Dowels bonded on only one side of a joint.

K. WORKER SAFETY: Workers placing reinforcing steel shall wear safety equipment and harnesses as required by state occupational safety regulations.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section covers the production of cast-in-place structural concrete. Included are methods and procedures for obtaining quality concrete through proper handling, placing, finishing, curing, and repair of surface defects.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 03 00 00 – Concrete General Requirements.
2. Section 03 11 00 – Concrete Formwork.
3. Section 03 15 00 – Concrete Accessories.
4. Section 03 15 10 – Openings and Penetrations in Construction.
5. Section 03 20 00 – Concrete Reinforcement.
6. Section 03 31 10 – Concrete Mixtures.
7. Section 03 31 11 – Cold Weather Concreting.
8. Section 03 31 12 – Hot Weather Concreting.
9. Section 03 60 00 – Grout.

1.02 STANDARDS AND CODES

Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Submit the following data unless otherwise specified:
    a. Field Control Test Reports. Maintain and submit accurate records of all test and inspection reports.
    b. Conveying Equipment. Submit description of conveying equipment.
    c. Temperature Measurement. Submit proposed method of measuring concrete surface temperature changes.
    d. Repair Methods. When stains, rust, efflorescence, and surface deposits must be removed as described in 3.07.G, submit the proposed method of removal.

e. Placement Notification. Submit notification at least 24 hours in advance of concrete placement.

f. Pre-placement Requirements. Submit requests for acceptance of reinforcement and form placement at least 48 hours in advance of concrete placement.

g. Wet Weather Placement. When placement is scheduled during wet weather, submit request for acceptance of protection.

h. Cold Weather Placement. When placement of concrete is subject to the requirements of Section 03 31 11 – Cold Weather Concreting, submit request for placement along with the submittals required by those sections.

i. Cold Weather Placement. When placement of concrete is subject to the requirements of Section 03 31 12 – Hot Weather Concreting, submit request for placement along with the submittals required by those sections.

j. Qualifications of Finishers. Submit qualifications of the finishing contractor and flatwork finishers who will perform the work described in 3.03 and 3.04.

2. Submit the following data when required:

a. Matching Sample Finish. When special finishes are required by Contract Documents, submit sample finish described in 3.03.B.

b. Exposed Aggregate Surface. When an exposed aggregate surface is specified and a chemical retarder is proposed to be used, submit specification and data on the retarder and proposed method of use of retarder.

3. Submit the following data when alternatives are proposed:

a. Construction Joints. Submit information for acceptance of proposed location and treatment of construction joints proposed but not indicated on the Contract Drawings. The determination of acceptability of proposed construction joints shall be made solely by the Engineer.

b. Two-Course Slabs. When a bonding agent other than cement grout is proposed, submit specification and data of bonding agent.

c. Underwater Placement. When underwater placement is planned, submit request for acceptance of proposed method.

d. Saw Cut Joints. When sawcut joints other than those indicated on the Contract Drawings are proposed, submit request of the proposed method.

e. Moisture-Preserving Method. When a moisture-preserving method other than specified in 3.06.D is proposed, submit request of the proposed method.

f. Coated Ties. When coated form ties described in 3.07.B are proposed to preclude the requirement to patch tie holes, submit proposed coated tie description.

g. Repair Material. When repair material described in 2.01.C, Proprietary Patching Materials, is proposed, submit the repair material specification, data on the proposed patching material, and proposed preparation and application procedure.

1.04 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Place concrete within the time limits required in Specification Section 03 31 10 – Concrete Mixtures.

B. STORAGE AND HANDLING: Store and handle products to retain original quality. Do not use products stored beyond the manufacturer's recommended shelf life.

PART 2 : PRODUCTS

2.01 MATERIALS

A. CURING COMPOUNDS: Where the use of curing compounds is approved by the Engineer, use curing compounds that conform to ASTM C309 or ASTM C1315. Curing compound shall be translucent with fugitive dye. Combination curing compound/sealer products shall not be used unless sealer is part of the specified finish.

1. Where concrete is to be coated with moisture- or waterproofing compound or sealer, curing compounds shall not be used unless certified by the manufacturer as not adversely affecting the bond or performance of subsequently applied coatings, or shall be removed after completion of the cure using light water blast in accordance with manufacturer's recommendations.

B. SHEET MATERIALS FOR CURING CONCRETE: Use sheeting materials that conform to ASTM C171.

C. PROPRIETARY PATCHING MATERIALS: Use acceptable proprietary patching materials complying with 3.07.F, Repair Materials Other Than Site-Mixed Portland Cement Mortar.

D. BONDING GROUT: Use bonding grout in accordance with 3.07.D, Preparation of Bonding Grout.

E. SITE-MIXED PORTLAND CEMENT REPAIR MORTAR: Use repair mortar in accordance with 3.07.E, Site-Mixed Portland Cement Repair.

F. FLOOR HARDENER: Floor hardener shall be a graded, iron aggregate base compound for dry-shake application and trowel embedment into fresh concrete. The compound shall be packaged in 90-lb, poly-lined bags and shall contain a dispersing agent, Portland cement and a stable lime-proof pigmentation to color the application gray. Wet cure or use curing compound recommended by the hardener manufacturer.

G. FLOOR SEALER: See Specification Section 09 91 23 – Building Interior Painting.

PART 3 : EXECUTION

3.01 PREPARATION

A. Do not place concrete until data on materials and mixture proportions are accepted.

B. Remove hardened concrete and foreign material from the inner surfaces of conveying equipment.

C. Before placing concrete in forms, complete the following:

1. Comply with formwork requirements specified in Section 03 11 00 – Concrete Formwork.
2. Remove snow, ice, frost, water, and other foreign material from surfaces, including reinforcement and embedded items, against which concrete will be placed.
3. Comply with reinforcing steel placement requirements in Section 03 20 00 – Concrete Reinforcement.
4. Position and secure in place expansion joint material, anchors, and other embedded items.
5. Obtain acceptance of finished preparation.

D. Before placing a concrete slab on grade, clean foreign material from the subgrade and complete the following:

1. Subgrade shall be well drained and of uniform load-bearing nature.
2. In-place density of subgrade soils shall be uniform throughout the area and at least the minimum required by Contract Documents.
3. Subgrade shall be free from frost or ice.
4. Subgrade shall be moist with no free water and no muddy or soft spots.
5. If a slipsheet is indicated on the Contract Drawings, slabs and foundations on grade shall be underlain with two layers of 8 mil. polyethylene sheeting; perforated to allow bleedwater to escape.

E. When high evaporative conditions necessitate protection of concrete immediately after placing or finishing, make provisions in advance of concrete placement for windbreaks, shading, fogging, sprinkling, ponding, or wet covering.

F. During cold weather or hot weather concreting conditions described in Section 03 31 11 – Cold Weather Concreting or 03 31 12 – Hot Weather Concreting, make provisions in advance of concrete placement to maintain the temperature of the concrete as required.

3.02 PLACEMENT OF CONCRETE

A. WEATHER AND EXPOSURE CONSIDERATIONS

1. Wet Weather. Do not begin to place concrete while rain, sleet, or snow is falling unless adequate protection is provided, and approval of protection is obtained from the Engineer. Do not allow rainwater to increase mixing water or to damage the surface of the concrete.
2. Cold Weather concreting procedures shall conform to Section 03 31 11 – Cold Weather Concreting.
3. Hot Weather concreting procedures shall conform to Section 03 31 12 – Hot Weather Concreting.
4. Concrete Placed in Water. No concrete shall be placed underwater or in standing water unless specifically directed or approved by the Engineer and as provided for in these Specifications and shown on the Contract Drawings. Underwater concrete shall be placed using tremies or other special methods subject to approval by the Engineer, and only concrete mixtures specifically formulated for underwater placement shall be used.

B. CONVEYING

1. Convey concrete from mixer to the place of final deposit rapidly by methods which prevent segregation or loss of ingredients and will assure the required quality of concrete. Do not use aluminum pipes or chutes.

C. CONVEYING EQUIPMENT

1. Use acceptable conveying equipment of a size and design that will prevent cold joints from occurring. Clean conveying equipment before each placement.
    a. Use belt conveyors that are horizontal or at a slope that will not cause excessive segregation or loss of ingredients. Project concrete to minimize drying and the effects of temperature rise. Use an acceptable discharge baffle or hopper at the discharge end to prevent segregation. Do not allow mortar to adhere to the return length of the belt.
    b. Use metal or metal-lined chutes having rounded bottoms and sloped between 1 vertical to 2 horizontal and 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting slope requirements may be used provided the discharge is into a hopper before distributing into the forms.
    c. Use pumping conveying equipment that permits placement rates that avoid cold joints and prevents segregation in discharge of pumped concrete.

D. DEPOSITING

1. All concrete shall be delivered, discharged, and placed as specified in Section 03 31 10 – Concrete Mixtures, 3.02 and ACI 301 Section 5.3.

2. Deposit concrete continuously in one layer or in layers to have fresh concrete deposited on in-place concrete that is still plastic. Do not deposit fresh concrete on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section.

3. Once concreting is started, it shall be carried on as a continuous operation until the placing of the panel or section is complete. Suspension of operations for more than 1½ hours will not be permitted during a continuous placement, and this limit may be shortened on order by the Engineer.

4. Concrete shall be placed generally in horizontal layers not more than 24 inches thick, except as otherwise specified. Each layer of concrete is regarded as a unit of masonry to be laid and worked before the succeeding layer can be superimposed in the process of monolithic construction. When a monolithic layer cannot be completed in one operation, it shall be terminated with a vertical bulkhead. Feathering out to less than 6 inches will not be permitted.

5. Concrete shall be placed so as to prevent segregation of the materials and the displacement of the reinforcement. Where placing operations would involve the dropping of concrete through completed forms from heights of 4 or more feet, concrete so placed shall be pumped or discharged into hoppers feeding into flexible drop chutes to within 2 feet of the concrete's final deposition point.

6. Do not use concrete that has surface dried, partially hardened, or contains foreign material.

7. When temporary spreaders are used in the forms, remove the spreaders as their service becomes unnecessary. Spreaders made of metal or concrete may be left in place if prior acceptance is obtained.

8. Do not place concrete over columns and walls until concrete in columns and walls is no longer plastic and has been in place at least 1 hour.

9. Do not subject concrete to any procedure that will cause segregation. Deposit concrete as near as practicable to the final position to avoid segregation.

10. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs.

11. When placing concrete for columns, do not exceed the top-of-pour elevation indicated on the Contract Drawings for the joint between the column and the slab or drop panel it supports.

12. When underwater placement is required or permitted, place concrete by an acceptable method. Deposit fresh concrete so concrete enters the mass of the previously placed concrete from within, displacing water with minimum disturbance to the surface of concrete.

E. CONSOLIDATING

1. Consolidate concrete by vibration. Concrete shall be thoroughly worked around reinforcement and embedded items and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Use internal vibrators of the largest size and power that can properly be used in the work. Workers shall be experienced in use of the vibrators. Do not use vibrators to move concrete within the forms.
2. The Contractor shall supply enough vibrators to consolidate the concrete (except that placed underwater) according to the requirements of this Section. Each vibrator must:
    a. Be designed to operate while submerged in the concrete;
    b. Vibrate at a rate of at least 7,000 pulses per minute; and
    c. Receive the Engineer's approval on its type and method of use.
3. Immediately after concrete is placed, vibration shall be applied in the fresh batch at the point of deposit. In doing so, the Contractor shall:
    a. Space the vibrators evenly, no farther apart than twice the radius of the visible effects of the vibration;
    b. Ensure that vibration intensity is great enough to visibly affect the concrete across a radius of at least 18 inches;
    c. Insert the vibrators slowly to a depth that will effectively vibrate the full depth of each layer, penetrating into the previous layer on multilayer pours;
    d. Protect partially hardened concrete (i.e., non-plastic, which prevents the vibrator penetration when only its own weight is applied) by preventing the vibrator from penetrating it or making direct contact with steel that extends into it;
    e. Not allow vibration to continue in one place long enough to form pools of grout;
    f. Continue vibration long enough to consolidate the concrete thoroughly, but not so long as to segregate it;
    g. Withdraw the vibrators slowly when the process is complete; and
    h. Not use vibrators to move concrete from one point to another in the forms.
    i. Use internal vibrators of the largest size and power than can properly be used in the Work.
    j. Use immersion-type vibrators with nonmetallic heads when consolidating concrete around epoxy-coated reinforcement. Workers shall be experienced in use of the vibrators.
4. When vibrating and finishing top surfaces that will be exposed to weather or wear, the Contractor shall not draw water or laitance to the surface. In high lifts, the top layer shall be shallow and made up of a concrete mix as stiff as can be effectively vibrated and finished.

5. To produce a smooth, dense finish on outside surfaces, the Contractor shall hand tamp the concrete.

F. CONSTRUCTION JOINTS AND OTHER BONDED JOINTS

1. Locate construction joints as indicated per the Drawings or as accepted in accordance with 1.03.A.3.a. The use of construction joints not shown on the Drawings is prohibited unless approved by the Engineer. Formed construction joints shall be thoroughly cleaned, laitance removed, and dampened prior to placement of fresh concrete. When bond is required or permitted, it shall be achieved by one of the following:

   a. Use an acceptable adhesive applied in accordance with the manufacturer's recommendations.

   b. Use an acceptable surface retarder in accordance with the manufacturer's recommendations.

   c. Roughen the surface in an acceptable manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, or damaged concrete at the surface.

   d. Use Portland cement grout of the same proportions as the mortar in the concrete in an acceptable manner.

G. CONTRACTION/CONTROL JOINTS

1. The location of contraction or control joints shall be as shown on the plans or as approved by the Engineer. Contraction joints shall be saw cut, preformed, or tooled ¼ inch wide by α of the slab depth, but not less than 1½ inches deep, unless otherwise detailed on the Contract Drawings. Contraction joints shall be finished with backing rod and sealant.

H. PIPE PENETRATIONS

1. Where pipes pass through the structure, they shall be cast in place, unless permission is given by the Engineer to do otherwise. Whenever these requirements interfere with the placement of reinforcing steel as indicated by the Contract Drawings, the bars shall be spread and rearranged as directed by the Engineer.

3.03 FINISHING FORMED SURFACES

A. GENERAL: After removal of forms, in accordance with Table 3.03.A, give each formed surface one or more of the finishes described in 3.03.B, Matching Sample Finish; 3.03.C, As-Cast Finishes; or 3.03.D, Rubbed Finishes. When Contract Documents do not specify a finish, finish surfaces as required by 3.03.E, Unspecified Finishes.

Table 3.03.A	
Location	**Finish Type**
Backfilled surfaces	Rough form finish
Exposed foundation surfaces	Smooth form finish
All other surfaces	Grout-cleaned finish

B. MATCHING SAMPLE FINISH: When the finish is required by the Contract Documents to match a sample panel furnished to the Contractor, reproduce the sample finish on an area at least 100 square feet in a location designated by the Engineer and obtain acceptance before proceeding with that finish in the specified location.

C. AS-CAST FINISHES

1. Rough Form Finish. Patch tie holes and defects. Chip or rub off fins exceeding ¼ inch in height. Leave surfaces with the texture imparted by the forms.

2. Smooth Form Finish. Patch tie holes and defects. Remove all fins completely.

3. Architectural Finishes. Produce architectural finishes including special textured finishes, exposed aggregate finish, and aggregate transfer finish in accordance with specifications for Architectural Concrete, if included in the Contract Documents.

D. RUBBED FINISHES: Remove forms as early as permitted by Section 03 11 00 – Concrete Formwork; 3.02, Removal of Formwork. Produce one of the following finishes on concrete specified to have a smooth form finish:

1. Smooth Rubbed Finish. Remove forms as early as permitted by Section 03 11 00 – Concrete Formwork and perform necessary patching. Produce finish on newly hardened concrete no later than the day following form removal. Wet the surface and rub it with carborundum brick or other abrasive until uniform color and texture are produced. Use no cement grout other than cement paste drawn from the concrete itself by the rubbing process.

2. Grout-Cleaned Finish. Begin cleaning operations after all contiguous surfaces to be cleaned are completed and accessible. Do not clean surfaces as Work progresses. Wet the surface and apply grout consisting of 1 part Portland cement and 1½ parts fine sand with enough water to produce the consistency of thick paint. Add white cement as needed to match color of surrounding concrete. Scrub grout into all voids and remove all excess grout. When grout whitens, rub the surface, and keep the surface damp for 36 hours afterwards.

3. Cork-Floated Finish. Perform necessary repairs. Remove ties, burrs, and fins. Wet the surface and apply stiff grout of one part Portland cement and one part fine sand, filling all voids. Add white cement as needed to match color of surrounding concrete. Use enough water to produce a stiff consistency. Compress grout into voids by grinding the surface with a slow-speed grinder. Produce the final finish with cork float, using a swirling motion.

E. UNSPECIFIED FINISHES: When a specific finish is not specified in the Contract Documents for a concrete surface, apply the following finishes:

1. Rough form finish on all concrete surfaces not exposed to public view.
2. Smooth form finish on all concrete surfaces exposed to public view.

3.04 FINISHING UNFORMED SURFACES

A. PLACEMENT: Place concrete at a rate that allows spreading, straight edging, and darbying or bull-floating before bleed water appears.

1. Strike smooth the top of walls, buttresses, horizontal offsets, and other similar unformed surfaces, and float them to a texture consistent with finish of adjacent formed surface.
2. Finish slab surfaces in accordance with one of the finishes in 3.04.B, Finishes, as specified in Table 3.04.A.

Table 3.04.A: Finish Schedule

Location	Finish Type
Interior Slabs	Troweled finish (with floor sealer, see Section 09 91 23 – Building Interior Painting)
Tops of footings or other backfilled surfaces	Floated finish
Exterior slabs, walks, and steps	Broom finish

B. FINISHES

1. Scratched Finish. Place, consolidate, strike off and level concrete, eliminating high spots and low spots. Roughen the surface with stiff brushes or rakes before the final set.
2. Floated Finish. Place, consolidate, strike off and level concrete, eliminating high spots and low spots. Do not work concrete further until it is ready for floating. Begin floating with a hand float, a bladed power float equipped with float shoes, or a powered disk float when the bleed water sheen has disappeared, and the surface has stiffened sufficiently to permit the operation. During or after the first floating, check flatness of surface with a 10-foot straightedge applied in two or more directions. Produce a conventional, straightedge finish in accordance with ACI 117, then refloat the slab immediately to a uniform texture.

3. Troweled Finish. Float concrete surface, then power trowel the surface. Hand trowel the surface smooth and free of trowel marks. Continue hand troweling until a ringing sound is produced as the floor is troweled. Tolerance for concrete floors shall be conventional straightedge in accordance with ACI 117, unless otherwise specified. Concrete surfaces intended to support floor covering shall not have defects that will reflect through floor covering. See Section 09 91 23 – Building Interior Painting for floor sealer on interior slabs.

4. Broom or Belt Finish. Immediately after concrete has received a steel-troweled finish, give the concrete surface a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

5. Dry-Shake Finish. Blend metallic or mineral aggregate floor hardener with Portland cement in the proportions recommended by the aggregate manufacturer, or use bagged premixed material as recommended by the manufacturer. Float finish the concrete surface. Apply approximately two-thirds of the blended material required for coverage to the surface by a method that ensures even coverage without segregation. Float finish the surface after application of the first dry-shake. Apply the remaining dry-shake material at right angles to the first application and in locations necessary to provide the specified minimum thickness. Begin final floating and finishing immediately after application of the dry-shake.

   After selected material is embedded by the two floating, complete operation with a broomed, floated, or troweled finish, as designated in the Contract Documents.

6. Heavy Duty Topping for Two-Course Slabs. For heavy duty topping mix, use materials and methods specified in Contract Documents. Place and consolidate concrete for the base slab and creed concrete to the specified depth below the top of the finish surface.

   Topping placed the same day as the base slab may be placed as soon as bleed water in the base slab has disappeared and the surface will support a person without appreciable indentation.

   When topping placement is deferred, brush the surface with a coarse wire broom to remove laitance and scratch the surface when concrete is plastic. Wet cure the base slab at least three days. Before placing the topping, clean the base slab surface thoroughly of contaminants and loose mortar or aggregate. Dampen the surface, leaving it free of standing water.

   Immediately before placing topping, scrub into the slab surface a coat of bonding grout consisting of equal parts of cement and fine sand with enough water to make a creamy mixture. Do not allow grout to set or dry before topping is placed. Bonding agents other than cement grout may be used with prior acceptance.

   Spread, compact, and float the topping mixture. Check for trueness of surface and float, trowel, or broom finish as specified.

7. Topping for Two-Course Slab Not Intended for Heavy Duty Service. Preparation of base slab, selection of topping material, mixing, placing, consolidating, and finishing operations shall be as specified in 3.04.B.6, Heavy Duty Topping for Two-Course Slabs, except that the aggregate need not be selected for special wear resistance.

8. Non-Slip Finish. Where a non-slip finish is required, give the surface a broom finish or belt finish or a dry-shake application of crushed aluminum oxide or other abrasive particles, as specified in the Contract Documents. Rate of application shall be not less than 25 pounds per 100 cubic feet.

9. Exposed Aggregate Finish. Immediately after surface of the concrete has been leveled to the specified straightedge method tolerance and the bleed water sheen has disappeared, spread aggregate of the color and size specified in Contract Documents uniformly over the surface to provide complete coverage to a depth of one stone.

   Tamp the aggregate lightly to embed aggregate in the surface. Float the surface until the embedded stone is fully coated with mortar and the surface has been brought to a true plane within the specified straightedge tolerance. After the matrix has hardened sufficiently to prevent dislodgement of the aggregate, apply water carefully and brush the surface with a fine bristle brush to expose the aggregate without dislodging it.

   An acceptable chemical retarder sprayed on freshly floated concrete surface may be used to extend the working time for the exposure of aggregate.

10. Non-Specified Finish. When the type of finish is not specified in Contract Documents, use one of the following appropriate finishes and accompanying tolerances.

    a. *Scratched Finish* — For surfaces intended to receive bonded cementitious mixtures.

    b. *Floated Finish* — For walks, drives, steps, ramps, and for surfaces intended to receive waterproofing, roofing, insulation, or sand-bed terrazzo.

    c. *Troweled Finish* — For floors intended as walking surfaces, floors in manufacturing, storage and warehousing areas, or for reception of floor coverings.

C. FINISHING TOLERANCES FOR SLABS

1. Finish floor slabs to meet the requirements of ACI 117 as specified in 3.04.B. Measure floor finish tolerances within 72 hours after slab finishing.

2. Unless otherwise specified in the Contract Documents, measure floor tolerances in accordance with the “10 ft. straightedge method” in ACI 117.

3.05 SAWED CONTRACTION JOINTS

Where saw cut joints are required or permitted, start cutting as soon as concrete has hardened sufficiently to prevent dislodgement of aggregates. Saw a continuous slot to a depth of one-fourth the thickness of the slab but not less than one inch. Complete sawing within 12 hours after placement.

3.06 CURING AND PROTECTION

A. GENERAL: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Protect concrete during the curing period such that the concrete temperature does not fall below the requirements of Section 03 31 11, Cold Weather Concreting. Cure concrete in accordance with Table 3.06.A and 3.06.C for 7 days after placement. High early strength concrete shall be cured for 3 days after placement.

B. Alternatively, moisture retention measures may be terminated when:

1. Tests are made on at least two additional cylinders kept adjacent to the structure and cured by the same methods as the structure, and tests indicate 70 percent of the specified compressive strength f_c', as determined in accordance with ASTM C39/C39M.
2. Temperature of the concrete is maintained at 50ºF or higher for the time required to achieve 85 percent of f_c' in laboratory-cured cylinders representative of the concrete in place.
3. Strength of concrete reaches f_c' as determined by accepted non-destructive methods meeting the requirements of Section 03 11 00 – Concrete Formwork, 3.04.B.

Table 3.06.A: Curing Method Schedule

Location	Method
Walls and floor slabs of liquid-retaining tanks and channels.	Wet method only per 3.06.D.1
All other locations	Wet method (3.06.D.1) or curing compound method (3.06.D.2)

4. During and following curing, do not allow the surface of the concrete to change temperature more than the following:
   a. 50ºF in any 24-hour period for sections less than 12 inches in the least dimension.
   b. 40ºF for sections from 12 to 36 inches in the least dimension.
   c. 30ºF for sections 36 to 72 inches in the least dimension.
   d. 20ºF for sections greater than 72 inches in the least dimension.
   e. The method of temperature measurement shall be accepted by the Engineer.

C. FORMED CONCRETE SURFACES: Keep absorbent wood forms wet until they are removed. After form removal, cure concrete by one of the methods in 3.06.D, Preservation of Moisture.

D. PRESERVATION OF MOISTURE: After placing and finishing, use one of the following methods, as required by Table 3.06.A, to preserve moisture in concrete:

1. Wet Cure Method. Provide continuous moisture by ponding or watering a covering of heavy quilted blankets, by watering and covering with a white reflective-type sheeting, or by wetting the outside surfaces of wood forms.
    a. Runoff water shall be collected and disposed of in accordance with all applicable regulations. In no case shall runoff water be allowed to enter any lakes, streams, or other surface waters.
    b. When curing slabs with wet heavy quilted blankets or burlap, a fog or mist spray of water shall be sprayed on the entire surface before the bleed water has evaporated. As soon as the concrete has achieved initial set, the surface shall be covered with presoaked heavy quilted blankets of burlap. The fog or mist spray shall be applied continuously until the presoaked heavy quilted blankets of burlap are placed. If the fog or mist spray cannot be applied continuously, two coats of curing compound shall be applied after the initial fog or mist spray application and before the presoaked heavy quilted blankets or burlap are placed.
    c. Ponding may be used for slabs on grade.
2. Curing Compound Method. Application of a curing compound conforming to ASTM C309. Apply the compound in accordance with manufacturer's recommendation after water sheen has disappeared from the concrete surface and after finishing operations.
    a. The rate of application shall not exceed 150 square feet per gallon.
    b. Apply in two applications at right angles to each other, not to exceed 150 square feet per gallon for each coat.
    c. Do not use curing compound on any surface where concrete or other material will be bonded unless the curing compound will not prevent bond or unless measures are to be taken to completely remove the curing compound from areas to receive bonded applications.
    d. No later than the morning after applying the curing compound, cover the top surfaces with white, reflective sheeting, leaving it in place for at least 10 days. Throughout this period, the sheeting shall be kept in place by taping or weighting the edges.

3.07 REPAIR OF SURFACE DEFECTS

A. GENERAL: Repair tie holes and surface defects immediately after form removal. Where the concrete surface will be textured by sandblasting or bush-hammering, repair surface defects before texturing.

B. REPAIR OF TIE HOLES

1. Plug tie holes except where stainless steel ties, non-corroding ties, or acceptably coated ties are used, and omission of plugging is approved by the Engineer.
2. When Portland cement patching mortar conforming to 3.07.E, Site Mixed Portland Cement Repair, is used for plugging, clean and dampen tie holes before applying the mortar.
3. When other materials are used, apply them in accordance with Manufacturer's recommendations.
4. Finish tie holes flush with surrounding wall for concealed surfaces and exposed surfaces of tanks and channels. For other exposed surfaces, finish to leave a leave a reveal 3/4-inch deep, unless otherwise directed by the Engineer.

C. REPAIR OF SURFACE DEFECTS OTHER THAN TIE HOLES

1. Outline honeycombed or otherwise defective concrete with a ½- to ¾-inch-deep saw cut and remove such concrete down to sound concrete. When chipping is necessary, leave chipped edges perpendicular to the surface or slightly undercut. Do not feather edges. Dampen the area to be patched, plus another 6 inches around the patch area perimeter. Prepare bonding grout according to 3.07.D, Preparation of Bonding Grout. Thoroughly brush grout into the surface.
2. When the bond coat begins to lose water sheen, apply patching mortar prepared in accordance with 3.07.E, Site-Mixed Portland Cement Repair, and thoroughly consolidate mortar into place. Strike mortar leaving the patch slightly higher than the surrounding surface to permit initial shrinkage.
3. Leave the patch undisturbed for 1 hour before finishing. Keep the patch damp for 7 days.

D. PREPARATION OF BONDING GROUT

1. For bonding grout, mix approximately one part of cement and one part of fine sand with water to a consistency of thick cream.

E. SITE-MIXED PORTLAND CEMENT REPAIR

1. Mix repair mortar using the same materials as concrete to be patched with no coarse aggregate. Use not more than one part cement to two and one-half parts sand by loose damp volume.
2. For repairs in exposed concrete, make a trial batch and check color compatibility of repair material with surrounding concrete. When the repair is too dark, substitute white Portland cement for a part of the gray cement to produce a color closely matching surrounding concrete.
3. Use a repair mortar at a stiff consistency with no more mixing water than is necessary for handling and placing. Mix the repair mortar and manipulate the mortar frequently with a trowel without adding water. Use mortar at a stiff consistency.

4. Repair mortar may be used for holes at least 1 inch deep where the depth is equal to or greater than the smallest surface dimension of the defect, and for narrow slots cut for the repair of cracks. Do not use where lateral restraint cannot be obtained. Place and dry-pack mortar in layers having a compacted thickness of approximately ½ inch.

5. Solidly compact each layer over its entire surface by use of a hardwood stick and hammer. Do not use metal tools for compacting. compact surface just flush with adjacent area. Do not use steel finishing tools or water to facilitate finishing.

F. REPAIR MATERIALS OTHER THAN SITE-MIXED PORTLAND CEMENT MORTAR: Materials other than site-mixed Portland cement may be used for repair when prepared by the Engineer. Materials include, but are not limited to:

1. Shotcrete.

2. Commercial Patching Products. Including:

   a. Portland cement mortar modified with a latex bonding agent, conforming to ASTM C1059 Type II.

   b. Epoxy mortars and epoxy compounds that are moisture-insensitive during application and after curing, which embody an epoxy binder that conforms to ASTM C881, Type III. The type, grade, and class shall be appropriate for the application as specified in ASTM C881.

   c. Shrinkage-compensating or non-shrink Portland cement grout, conforming to ASTM C1107.

   d. Packaged dry concrete repair materials, conforming to ASTM C928.

G. REMOVAL OF STAINS, RUST, EFFLORESCENCE AND SURFACE DEPOSITS

1. Remove stains, rust efflorescence and surface deposits considered objectionable by Engineer by acceptable methods.

H. CONCRETE REPLACEMENT: Use concrete replacement for:

1. Holes extending entirely through concrete sections.

2. For holes larger than 1 square foot and deeper than 4 inches in which no reinforcement is encountered.

3. For holes larger than ½ of 1 square foot where reinforcement is exposed.

Concrete used for replacement shall be the same strength and mixture as used in the structure.

END OF SECTION

SECTION 03 31 10
CONCRETE MIXTURES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes requirements for materials, proportioning, production, and delivery of concrete.

B. Related Specification sections include but are not necessarily limited to:

1. Section 03 00 00 – Concrete General Requirements.
2. Section 03 11 00 – Concrete Formwork.
3. Section 03 15 00 – Concrete Accessories.
4. Section 03 15 10 – Openings and Penetrations in Construction.
5. Section 03 20 00 – Concrete Reinforcement.
6. Section 03 30 00 – Cast-In-Place Concrete.
7. Section 03 31 11 – Cold Weather Concreting.
8. Section 03 31 12 – Hot Weather Concreting.
9. Section 03 60 00 – Grout.

1.02 STANADARDS AND CODES

Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. MIXTURE PROPORTIONS: Submit concrete mixture proportions and characteristics.
2. MIXTURE PROPORTION DATA: Submit field test data used to establish the required average strength in accordance with 2.03.C, Required Average Compression Strength. Submit for acceptance test data used to establish the average compression strength of the mixture in accordance with 2.03.D, Documentation of Required Average Strength. Submit shrinkage test data for mixes used for grade slabs, walls, or elevated slabs.
3. CONCRETE MATERIALS: Submit the following information for concrete materials, along with evidence demonstrating compliance with 2.01, Materials:

a. For Cementitious Materials. Types, classes, producers' names, plant locations, and evidence not more than 90 days old demonstrating compliance with 2.01, Materials.

b. For Aggregates. Types, pit or quarry locations, producers' names, gradations, specific gravities and evidence not more than 90 days old demonstrating compliance with 2.01, Materials.

c. For Admixtures. Types, brand names, producers, manufacturer's technical data sheets, and certification data.

d. For Water. Source of supply.

4. FIELD TEST DATA BASIS: When field test data is used as a basis for selecting proportions for a concrete mixture, submit data on materials and mixture proportions, with supporting test results confirming conformance with specified requirements.

5. MIXTURE PROPORTION ADJUSTMENTS: Submit any adjustments to mixture proportions or changes in materials, along with supporting documentation, made during the course of the Work.

6. CALCIUM CHLORIDE: Calcium chloride shall not be added to the concrete.

7. VOLUMETRIC BATCHING: When it is desired to produce concrete by the volumetric batch method, submit request along with description of proposed method.

8. TIME OF DISCHARGE: When it is desired to exceed time for discharge of concrete required by ASTM C94, submit a request along with a description of the precautions to be taken.

9. SUBMITTAL PROCESSING: Initial submittal of above data shall be not less than 40 calendar days before the planned production date.

1.04 QUALITY CONTROL

A. The Contractor shall maintain records verifying materials used are of the specified and accepted types and sizes and are in conformance with the requirements of 2.01, Materials.

B. The Contractor shall ensure that production and delivery of concrete conform to the requirements of 3.01, Measuring, Batching and Mixing and 3.02, Delivery.

C. The Contractor shall ensure that the concrete produced has the specified characteristics in the freshly mixed state and that they are maintained during transport and delivery.

D. Concrete mixing and placement is subject to continuous Special Inspection. The Contractor shall oversee and schedule placement and testing activities with the Special Inspector. Provide ample notice prior to concrete placement (48 hours minimum).

E. PRODUCTION FACILITY CERTIFICATION REQUIREMENTS:

1. The Concrete Batch Plant and Delivery Vehicles shall be certified in accordance with the National Reinforced Concrete Manufacturer's Association (NRCMA) Certification of Ready Mix Concrete Production Facilities.

2. The Concrete Batch Plant Operator shall be certified by the National Reinforced Concrete Manufacturer's Association as a Ready Mix Concrete Plant Manager.

1.05 MATERIALS STORAGE AND HANDLING

A. CEMENTITIOUS MATERIAL: Store cementitious materials in dry, weathertight buildings, bins, or silos which will exclude contaminants.

B. AGGREGATES: Store and handle aggregate in a manner that will avoid segregation and prevent contamination with other materials or other sizes of aggregates. Store aggregates to drain freely. Do not use aggregates that contain frozen lumps.

C. WATER: Protect mixing water from contamination during storage and delivery.

D. ADMIXTURES: Protect stored admixtures against contamination, evaporation, or damage. Provide agitating equipment for admixtures used in the form of suspensions or non-stable solutions to ensure thorough distribution of ingredients. Protect liquid admixtures from freezing and from temperature changes which would adversely affect their characteristics.

PART 2 : PRODUCTS

2.01 MATERIALS

A. CEMENTITIOUS MATERIAL: Cementitious material shall consist of Portland cement conforming to ASTM C150, with or without the addition of cementitious or pozzolanic mineral admixtures conforming to ASTM C618 or ASTM C989, or blended hydraulic cement conforming to ASTM C595.

1. Cementitious material shall conform to ASTM C150, with type in accordance with Table 2.02.F.1.

2. The tricalcium aluminum (Ca3Al) content of the Portland cement shall be less than 8 percent in all concrete.

3. Cementitious material used in concrete shall be the same brand and type, and from the same plant of manufacture as the cementitious material used in the concrete represented by the submitted field test data or used in the trial mixtures.

4. When specified or permitted in combination with Portland cement, the following cementitious materials may also be used:

a. Fly ash conforming to ASTM C618, Class F, maximum 2% loss on ignition. When fly ash is used, the minimum amount shall be 15% by weight of the total cementitious materials unless otherwise specified.

b. Ground-granulated blast-furnace slag conforming to ASTM C989.

c. Silica fume conforming to ASTM C1240.

B. AGGREGATES: Aggregates shall conform to ASTM C33 unless otherwise specified.

1. When a single size or a combination of two or more sizes of coarse aggregates are used, the final gradation shall conform to the grading requirements of ASTM C33 unless otherwise specified or permitted.

2. All aggregates used for concrete shall be washed using fresh water and free of chlorides.

3. Aggregates used in concrete shall be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by submitted historical data, or used in trial mixtures.

C. WATER: Mixing water for concrete shall meet the requirements of ASTM C1602. Maximum water soluble chlorine concentration is 0.30 ppm. Under no circumstances shall seawater be used for the making of concrete or the washing of aggregate.

D. ADMIXTURES: Admixtures shall meet the requirements of the following:

1. Provide admixtures produced and serviced by an established, reputable manufacturer, used in compliance with Manufacturer's recommendations. All of the admixtures used shall be from the same manufacturer and compatible with each other.

a. *Air-entraining admixture:* Conform to ASTM C260. Admixture shall contain no chlorides and shall be capable of maintaining the air percentage as batched, within ±2% at point of placement, for 2 hours.

b. *Water-reducing set, set-controlling admixture:* Conform to ASTM C494, Type A or D. Admixture shall contain no chlorides, and shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the Manufacturer's recommendations to obtain at least 12% water reduction. No retarder shall be used without Engineer's approval. Submit written proposed details of use.

c. *Non-chloride, non-corrosive accelerators:* Conform to ASTM C494, Type E, Admixture. Admixture shall be non-chloride and shall not promote corrosion of reinforcing steel in concrete.

d. *High-range water reducer:* Conform to ASTM C494, Type F or G. The admixture shall be free of chlorides and alkalines. Water reducers shall be batch plant added.

e. *Chemical admixtures for producing flowing concrete:* Conform to ASTM C1017.

f. *Fiber reinforcement:* Fiber reinforcement shall be nominal ½-inch fibrillated polypropylene, Fibermesh, W.R. Grace, or other approved polypropylene product designed specifically for control of shrinkage and drying cracking in Portland cement concrete.

g. *Retarding admixture:* Confirm to ASTM C494, Type B. Admixtures used in concrete shall be the same as those used in the concrete represented by submitted field test data or used in trial mixtures.

E. CHANGE OF MATERIALS: When brand type, size, or source of cementitious materials, aggregates, water, ice, or admixtures are proposed to be changed, new field data or data from new trial mixtures or evidence which indicates that the change will not adversely affect the relevant properties of the concrete shall be submitted for acceptance before changes are made.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. CEMENTITIOUS MATERIAL CONTENT

1. The cementitious material content shall be adequate for concrete to satisfy the specified requirements for strength, water-cement ratio, and finishing ability. Not more than 20% fly ash may be substituted for Portland cement at the Contractor's option. However, mix designs with fly ash shall not be used for floor slabs.

2. For concrete used in floors, cement content shall not be less than indicated in Table 2.02.A unless approved by the Engineer.

3. When a history of finishing quality is not available, evaluate the proposed mixture by placing concrete in a slab at the job using job materials, equipment, and personnel. The slab shall be at least 8 feet square and have an acceptable thickness. Slump shall not exceed the specified slump. Submit the evaluation results for acceptance.

Table 2.02.A: Minimum Cement Content Requirements for Floors

Nominal Maximum Size of Aggregate (in.)	Minimum Cement Content (lb/yd)
1½	470*
1	520
¾	540
3/8	610

** Minimum cement content shall be 501 lb/yd³ if concrete will be exposed to freezing and thawing in the presence of de-icing chemicals.*

B. SLUMP: Concrete shall have, at the point of placement, slump in accordance with Table 2.02.B. Determine the slump by ASTM C143. Slump tolerances shall meet the requirements of ACI 117.

When use of a Type I or II plasticizing admixture conforming to ASTM C1017 or when a Type F or G high-range water-reducing admixture conforming to ASTM C494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 in. before the admixture is added and a maximum slump of 8 in. at the point of delivery after the admixture is added unless otherwise specified. Contractor to test slump at plant and provide information to Special Inspector.

Table 2.02.B: Slump Schedule		
	Maximum	**Minimum**
Slabs	4”	2”
Footings	3”	1”
Walls	5"	2"

C. SIZE OF COARSE AGGREGATE: Except when otherwise specified or permitted, nominal maximum size of coarse aggregate shall not exceed 3/4 of the minimum clear spacing between reinforcing bars; 1/5 of the narrowest dimension between sides of forms; or 1/3 of the thickness of slabs or toppings.

D. AIR CONTENT

1. Unless otherwise specified, concrete shall be air-entrained. Unless otherwise specified, air content at the point of delivery shall conform to the requirements of Table 2.02.D for moderate exposure.
2. Air content shall be measured in accordance with ASTM C138, C173, or C231. ASTM C231 shall be the preferred method.
3. Maximum air entrainment shall not exceed 3 percent for interior floor slabs to receive floor hardener and sealing compound.

Table 2.02.D: Total Air Content* of Concrete for Various Sizes of Coarse Aggregate			
Nominal Max. Size of Aggregate (in.)	**Total Air Content, + Percent**		
	Severe Exposure	**Moderate Exposure**	**Mild Exposure**
Less than 3/8	9	7	5
3/8	7.5	6	4.5
½	7	5.5	4
¾	6	5	3.5
1	6	4.5	3
1 ½	5.5	4.5	2.5
2	5	4	2
3	4.5	3.5	1.5
6	4	3	1.5

** Measured in accordance with ASTM C138, C137 or C231*
+ Air content tolerance is +1% to -1 ½%

E. ADMIXTURES: When admixtures are specified in the Contract Documents for particular parts of the Work, use the types specified.

1. Water-reducing admixtures may be used at the option of the Contractor.
2. Accelerators shall not be used without the approval of the Engineer.
3. Provide fiber reinforcement at an application rate of 1.5 lb/fiber per cubic yard of concrete where fiber reinforcement is specified.

F. CONCRETE CLASS AND LOCATION: The proportions of cement, aggregate, and water for concrete shall be determined by the Contractor and subject to the requirements of this Section. Concrete shall meet the following criteria. Mix classes identified as "WSDOT" shall be considered compliant with this Specification if in conformance with Section 6-02.3 of the Washington State Department of Transportation "Standard Specifications for Road, Bridge, and Municipal Construction" 2020 edition.

Table 2.02.F.1: Concrete Classifications

Property	WSDOT Class 3000	WSDOT Class 4000	Class 1	Class 2	Class 3
28-day Compressive Strength (psi)	3000	4000	4000	4000	4000
Cement Type, C150 (See Note 1)	I, II, or III	I, II, or III	II	II	II
Fly ash	Optional	Optional	Required	Required	Optional
Max water/cement-itious ratio	.58	50	.45	.45	.45
Minimum cement content, lbs/cy	564	564	See 2.02.A	See 2.02.A	See 2.02.A
Course aggregate gradation, C33	57 or 67	57 or 67	57 or 67	57	57
Entrained air	None	See Note 2	See Note 2	None	None

Notes:
1) Type III cement shall not be used without the prior approval of the Engineer and only if warranted by cold weather placement conditions.
2) Provide entrained air per Table 2.02.D, Moderate Exposure.

Table 2.02.F.2: Concrete Placement Schedule

Location	Concrete Class
Reinforced concrete exposed to the weather or earth	Class 1
Reinforced concrete not exposed to the weather except floor slabs on grade.	Class 2
Slabs on grade at interior locations	Class 3
Unreinforced concrete for pavements and sidewalk slabs	WSDOT Class 4000
Unreinforced concrete for thrust blocks, channel filler, and other general uses	WSDOT Class 3000

G. STRENGTH AND WATER-CEMENTITIOUS MATERIAL RATIO: The compressive strength and, when required, the water-cementitious material ratio of the concrete for each portion of the work shall be as specified in Paragraph F above.

1. If cementitious or pozzolanic mineral admixtures conforming to ASTM C618 or ASTM C989 are used, the cement portion of the water-cement ratio shall be the total weight of cementitious materials.

2. The maximum weight of fly ash, pozzolan or ground granulated blast-furnace slag that is included in the calculation of water-cementitious material ratio shall not exceed the following percentages of the total weight of cementitious materials given in Table 2.02.H.

Table 2.02.H: Maximum Cementitious Material Requirements for Concrete Exposed to Deicing Chemicals

Cementitious Material	Maximum Percent of Total Cementitious Material by Weight *
Fly ash or other pozzolans conforming to ASTM C618	25
Slag conforming to ASTM 989	50
Silica fume conforming to ASTM C1240	10
Total of fly ash or other pozzolans, slag, and silica fume	50 **
Total of fly ash or other pozzolans and silica fume	35 **

Notes:

*Total cementitious material also includes ASTM C150, C595 and C845 cement. The maximum percentages above shall include:

a) Fly ash or other pozzolans present in Type IP or I(PM) blended cement, ASTM C595;
b) Slag used in manufacture of an IS or I(SM) blended cement, ASTM C595; and
c) Silica fume, ASTM C1240, present in blended cement.

**Fly ash or other pozzolans and silica fume shall constitute no more than 25% and 10%, respectively, of the total weight of cementitious material.

3. Unless otherwise specified, strength requirements shall be based on the 28-day compressive strength determined on 4”x8” cylindrical specimens made and test in accordance with ASTM C31 and C39.

H. CONCRETE SHRINKAGE LIMITS: Concrete mixtures used for grade slabs, walls, or elevated slabs shall not exceed greater than 0.045 percent shrinkage at 28 days when tested in accordance with ASTM C157.

2.03 PROPORTIONING

A. Proportion concrete to conform with 2.02, Performance and Design Requirements, to provide workability and consistency so concrete can be worked readily into forms and around reinforcement without segregation or bleeding, and to provide an average compressive strength adequate to meet acceptance requirements.

1. If the production facility has records of field tests performed within the past 12 months and spanning a period of not less than 60 calendar days for a class of concrete within 1,000 psi of that specified for the Work, calculate a standard deviation and establish the required average compressive strength f'_{cr} in accordance with 2.03.B and 2.03.C.1. If field test records are not available, select the required average strength from Table 2.03.C.2.

B. STANDARD DEVIATION: Where a concrete production facility has test records, a standard deviation shall be established. Test records from which a standard deviation is calculated:

1. Must represent materials, quality control procedures, and conditions similar to those expected, and changes in materials and proportions within the test records shall not have been more restricted than those for proposed work.
2. Must represent concrete produced to meet a specified strength or strengths f'_c within 1,000 psi of that specified for the proposed work.
3. Must consist of at least 30 consecutive tests, or two groups of consecutive tests, totaling at least 30 tests, except as provided below.

   Where a concrete production facility does not have test records meeting the above requirements, but does have a record based on 15 to 29 consecutive tests, a standard deviation must be established as the product of the calculated standard deviation and the modification factor in Table 2.03.C.1. To be acceptable, the test record must meet the requirements of Items 1 and 2 and represent only a single record of consecutive tests that span a period of not less than 45 calendar days.

C. REQUIRED AVERAGE COMPRESSIVE STRENGTH: Calculate the required average compressive strength f'_{cr} for the specified concrete in accordance with one of the following:

1. Use the standard deviation calculated in accordance with 2.03.B to establish the required average compressive strength as follows:

   $f'_{cr} = f'_c + 1.34\,ks$

   $f'_{cr} + 2.33\,ks - 500$

   where:

   f'_{cr} = required average compressive strength
   f'_c = specified compressive strength
   s = Standard deviation calculated in accordance with ACI 318
   k = factor from Table 2.03.C.1 for increase in standard deviation if the total number of tests is less than 30

   The larger of the two values of f'_{cr} calculated in accordance with 2.03.C.1 shall be used.

Table 2.03.C.1: *k*-Factor for Increasing the Standard Deviation for Number of Tests Considered

Total No. of Tests Considered	*k* Factor for Increasing Standard Deviation
15	1.16
20	1.08
25	1.03
30 or more	1.00
Linear interpolation for intermediate number of tests is acceptable.	

2. When field test data is not available to establish a standard deviation, select the required average compressive strength f'_{cr} from Table 2.03.C.2.

Table 2.03.C.2: Required Compressive Strength f'_{cr} When Data Is Not Available to Establish a Standard Deviation	
Specified Strength f'_c	**Required Average Compressive Strength f'_{cr}**
Less than 3,000 psi	f'_c + 1,000 psi
3,000 to 5,000 psi	**f'_c + 1,200 psi**
Over 5,000	**1.1 f'_c + 700 psi**

D. DOCUMENTATION OF REQUIRED AVERAGE COMPRESSIVE STRENGTH: Documentation demonstrating that the proposed concrete proportions will produce an average compressive strength equal to or greater than the required average compressive strength f'_c shall consist of field strength records or trial mixtures.

1. Field Test Data. If field test data is available and represents a single group of at least 10 consecutive strength tests for one mixture, using the same materials and under the same conditions encompassing a period of not less than 60 days, verify that the average of the field test results equals or exceeds f'_{cr}. Submit for acceptance the mixture proportions along with the field test data.

   If the field test data represents two groups of compressive strength tests for two mixtures, plot the average strength of each group versus the corresponding mixture proportions, and interpolate between corresponding mixture proportions to establish mixture proportions for f'_{cr}.

2. Trial Mixtures. Establish mixture proportions based on trial mixtures in accordance with the following requirements:

   a. Use materials and material combinations proposed for the Work.

   b. Determine the required average compressive strength according to 2.03.C.1 if suitable field test data is available, or use Table 2.03.C.2.

   c. Make at least 3 trial mixtures complying with 2.02, Performance and Design Requirements. Each trial mixture shall have a different cementitious material content. Select water-cementitious material content. Select water-cementitious material ratios that will produce a range of compressive strengths encompassing the required average compressive strength f'_{cr}.

   d. Proportion trial mixtures to produce a slump within ¾" of the maximum specified, and for air-entrained concrete, an air content with 0.5 percent of the required total air content indicated in Table 2.02.D. The temperature of the freshly mixed concrete shall be recorded, and shall be within 10°F of the 90°F of the concrete as mixed and delivered.

e. For each trial mixture, make and cure 3 compressive strength cylinders for each test age in accordance with ASTM C192. Test for compressive strength in accordance with ASTM C39 at 28 days or at the test age specified in the Contract Documents.

f. From results of these tests, plot a curve showing the relationship between water-cementitious material ratio and compressive strength.

g. From the curve of water-cementitious material ratio versus compressive strength, select the water-cementitious material ratio corresponding to the required average compressive strength f'_{cr}. This is the maximum water-cementitious material ratio that may be used to establish mixture proportions unless a lower water-cement ratio is specified in 2.02.G, Strength and Water-Cementitious Material Ratio.

h. Establish mixture proportions so that the maximum water-cementitious material ratio is not exceeded when slump is at the maximum specified.

E. FIELD VERIFICATION OF ADEQUACY OF SELECTED PROPORTIONS: Using materials accepted for use in the Work, verify in the field the adequacy of the selected proportions to produce concrete with the required total air content and consistency, and with workability compatible with the intended placing method. Make suitable corrections as necessary and submit for acceptance the adjusted proportions.

PART 3 : EXECUTION

3.01 MEASURING, BATCHING AND MIXING

A. Production facilities shall produce concrete of the specified quality and conforming to the requirements of this Specification.

B. READY-MIXED AND SITE-PRODUCED CONCRETE: Unless otherwise specified, measure, batch and mix concrete materials and concrete in conformance with ASTM C94.

C. CONCRETE PRODUCED BY VOLUMETRIC BATCHING AND CONTINUOUS MIXING: When concrete made by volumetric batching and continuous mixing is permitted, it shall conform to the requirements of ASTM C685.

D. PREPACKAGED DRY MATERIALS USED IN CONCRETE: If packaged dry combined materials are used, they shall conform to the requirements of ASTM C387.

3.02 DELIVERY

A. Deliver concrete which will possess the specified characteristics in the freshly mixed state at the point of placing. Transport and deliver concrete in equipment conforming to the requirements of ASTM C94.

B. SLUMP ADJUSTMENT: When concrete arrives at the point of delivery with a slump below that which will result in the specified slump at the point of placement and is unsuitable for placing at that slump, the slump may be adjusted to the required value by adding water up to the amount allowed in the accepted mixture proportions when permitted by the Engineer.

1. Addition of water shall be in accordance with ASTM C94.
2. Do not exceed the specified water-cementitious material ratio or slump.
3. Do not add water to concrete containing a plasticizing or a high-range, water-reducing admixture.
4. Do not add water to concrete delivered in equipment not acceptable for mixing.
5. Measure slump and air content of air-entrained concrete, after slump adjustment, to verify compliance with specified requirements.

C. TIME OF DISCHARGE: Time for completion of discharge shall be within 90 minutes of the first addition of cement to the truck.

1. This length of time may be extended, on a case-by-case basis, an additional 30 minutes at the discretion of the Engineer or the Owner's Resident Project Representative provided the mix remains fluid and placeable and shows no signs of stiffening or set.
2. If delivery logistics make it impractical to discharge concrete within the above time limits, the Contractor may use an approved retarder admixture, delay the introduction of mixing water until the truck is closer to the job site, or propose other means, subject to approval by the Engineer, to assure that concrete is in acceptable condition at the time of discharge.

D. BATCH TICKET INFORMATION: The manufacturer of the concrete shall furnish to the Contractor and to the Owner's Representative with each batch of concrete before unloading at the site, a delivery ticket on which is printed, stamped, or written, information concerning said concrete as follows:

1. Name of ready-mix batch plant.
2. Serial number of ticket.
3. Date.
4. Truck number.
5. Name of purchaser.
6. Specific designation of job (name and location).
7. Specific class or designation of the concrete in conformance with that employed in job specifications.
8. Amount of concrete in cubic years (or cubic meters).
9. Time loaded or of first mixing of cement and aggregates.
10. Water added by receiver of concrete and his initials.
11. Reading of revolution counter at the first addition of water.

12. Type and brand, and amount of cement.
13. Type and brand, and amount of admixtures.
14. Information necessary to calculate the total mixing water added by the producer. Total mixing water includes free water on the aggregates, water, and ice batched at the plant, and water added by the truck operator from the mixer tank.
15. Maximum size of aggregate.
16. Weights of fine and coarse aggregate.
17. Ingredients certified as being previously approved.
18. Signature or initials of ready-mix representative.
19. The Contractor shall keep a record of where in the work each batch was placed.

END OF SECTION

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SECTION 03 31 11
COLD WEATHER CONCRETING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section covers requirements for cold weather concreting and protection of concrete from freezing during the specified protection period.

B. Related Specification sections include but are not necessarily limited to:

1. Section 03 00 00 – Concrete General Requirements.
2. Section 03 11 00 – Concrete Formwork.
3. Section 03 15 00 – Concrete Accessories.
4. Section 03 15 10 – Openings and Penetrations in Construction.
5. Section 03 20 00 – Concrete Reinforcement.
6. Section 03 30 00 – Cast-in-Place Concrete.
7. Section 03 31 10 – Concrete Mixtures.
8. Section 03 31 12 – Hot Weather Concreting.
9. Section 03 60 00 – Grout.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

B. DEFINITIONS

1. COLD WEATHER: A period when for more than 3 successive days the average daily outdoor temperature drops below 40ºF. The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50ºF occur during more than half of any 24-hour duration, the period shall no longer be regarded as cold weather.
2. COLD WEATHER CONCRETING: Operations concerning the placing, finishing, curing, and protection of concrete during cold weather.
3. PROTECTION PERIOD: The required time during which the concrete is maintained at or above a specific temperature in order to prevent freezing of concrete or to ensure the necessary strength development for structural safety.
4. Other definitions shall be as described in Section 03 00 00 – Concrete General Requirements.

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. The Contractor shall submit detailed, written procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during cold weather. In the submittal, include procedures to be implemented upon abrupt changes in weather conditions or equipment failures. Do not begin cold weather concreting until these procedures have been reviewed by the Owner's Resident Project Representative and the Engineer.

2. The details shall include, but not be limited to, the following:

   a. Procedures for protecting the subgrade from frost and the accumulation of ice or snow on reinforcement or forms prior to placement.

   b. Methods for temperature protection during placement.

   c. Types of covering, insulation, housing, or heating to be provided.

   d. Curing methods to be used during and following the protection period.

   e. Use of strength-accelerating admixtures.

   f. Methods of verification of in-place strength.

   g. Procedures for measuring and recording concrete temperatures.

   h. Procedures for preventing drying during dry, windy conditions.

PART 2 : PRODUCTS

2.01 SCHEDULING PROTECTION MATERIALS

All materials and equipment required for protection shall be available at the project site before cold weather concreting.

2.02 CONCRETE

Concrete for slabs and other flatwork exposed to cycles of freezing and thawing in a wet condition during the construction period shall be air entrained as specified in ACI 301, even though the concrete may not be exposed to freezing in service.

PART 3 : EXECUTION

3.01 PREPARATION BEFORE CONCRETING

Remove all snow, ice, and frost from the surfaces, including reinforcement, against which the concrete is to be placed. Before beginning concrete placement, completely thaw the subgrade. Do not place concrete around embedded pipe penetrations identified in the Contract Documents unless such embedments are at a temperature above freezing.

3.02 CONCRETE TEMPERATURE

A. PLACEMENT TEMPERATURE: The minimum temperature of concrete immediately after placement shall be as specified in Column 2 of Table 3.02A. The temperature of concrete as placed shall not exceed the values shown in Column 2 of Table 3.02A by more than 20ºF.

Table 3.02.A: Concrete Temperature

(1)	(2)	(3)
Least dimension of section	Minimum temperature of concrete as placed and maintained during the protection period.	Maximum gradual decrease in surface temperature during any 24-hour period after end of protection.
Less than 12 inches	55 ºF	50 ºF
12 inches to less than 36 inches	50 ºF	40 ºF
36 inches to 72 inches	45 ºF	30 ºF
Greater than 72 inches	40 ºF	20 ºF

B. PROTECTION TEMPERATURE: Unless otherwise specified, the minimum temperature of concrete during the protection period shall be as shown in Column 2 of Table 3.02A. Temperatures specified to be maintained during the protection period shall be those measured at the concrete surface, whether the surface is in contact with formwork, insulation, or air. Measure the temperature of concrete in each placement not less than twice daily at regular time intervals, using a surface temperature measuring device having an accuracy of ± 2ºF.

C. TERMINATION OF PROTECTION: The maximum decrease in temperature measured at the surface of the concrete in a 24-hour period shall not exceed the values shown in Column 3 of Table 3.02A. Do not exceed these limits until the surface temperature of the concrete is within 20ºF of the ambient or surrounding temperatures. When the surface temperature of the concrete is within 20ºF of the ambient or surrounding temperature, all protection may be removed.

3.03 CURING OF CONCRETE

Prevent concrete from drying during the required curing period. If water curing is used, terminate use at least 24 hours before any anticipated exposure of the concrete to freezing temperatures.

3.04 PROTECTION OF CONCRETE

A. COMBUSTION HEATERS: Vent flue gases from combustion heating units to the outside of the enclosure.

B. OVERHEATING AND DRYING: Place and direct heaters and ducts to avoid areas of overheating or drying of the concrete surface.

C. MAXIMUM AIR TEMPERATURE: During the protection period, do not expose the concrete surface to air having a temperature more than 20ºF above the values shown in Column 2 of Table 3.02A, unless higher values are required by an accepted curing method.

D. PROTECTION AGAINST FREEZING: Cure and protect concrete against damage from freezing for a minimum period of 3 days, unless otherwise specified. Maintain the surface temperature of the concrete during that period in accordance with Column 2 of Table 3.02A, unless otherwise specified. The protection period may be reduced to 2 days if use of one or more of the following to alter the concrete mixture is accepted:

1. Type III Portland cement meeting the requirements of ASTM C150.
2. A strength-accelerating admixture meeting the requirements of ASTM C494.
3. 100 lb/yd^3 of additional cement.

During periods not defined as cold weather, but when freezing temperatures are forecast to occur, protect concrete surfaces against freezing for the first 24 hours after placing.

E. PROTECTION FOR STRUCTURAL SAFETY: If the concrete strength is required for structural safety, extend the duration of the protection period to ensure the necessary strength development.

F. PROTECTION DEFICIENCY: If the temperature requirements during the specified protection period are not met but the concrete was prevented from freezing, continue protection until twice the deficiency of protection in degree-hours is made up. Deficient degree-hours may be determined by multiplying the average deficiency in temperature by the number of hours the temperature was below the values shown in Column 2 of Table 3.02A.

END OF SECTION

SECTION 03 31 12
HOT WEATHER CONCRETING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section covers requirements for placement of concrete during hot weather.

B. Related Specification sections include but are not necessarily limited to:

1. Section 03 00 00 – Concrete General Requirements.
2. Section 03 11 00 – Concrete Formwork.
3. Section 03 15 00 – Concrete Accessories.
4. Section 03 15 10 – Openings and Penetrations in Construction.
5. Section 03 20 00 – Concrete Reinforcement.
6. Section 03 30 00 – Cast-in-Place Concrete.
7. Section 03 31 10 – Concrete Mixtures.
8. Section 03 31 11 – Cold Weather Concreting.
9. Section 03 60 00 – Grout.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

B. Definition

1. Hot weather is defined as any combination of high ambient temperature, high concrete temperature, low relative humidity, wind velocity, and solar radiation, tending to impair the quality of fresh or hardened concrete, or otherwise resulting in detrimental concrete properties. During hot weather, any or all of the methods specified herein for temperature control of concrete shall be used as required to maintain the concrete temperature below the limits specified.

1.03 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Aggregate piles, cement bins and batch plant bins shall be shaded from the direct rays of the sun, when possible.

B. Aggregate piles may be cooled by wetting and evaporation. Aggregate wetting shall be performed in such a manner that is accounted for in the total water added to the mix.

1.04 GENERAL PRACTICES AND MEASURES

A. The Contractor shall be responsible for practices and procedures to ensure that concrete quality is not adversely affected by hot weather. Practices and procedures and combinations thereof may include the following:

1. Retarding admixtures.
2. Cooling of aggregates and/or mix water.
3. Reduction in time of discharge and expedited placement.
4. Shading and/or cooling of the placement site.
5. Use of cements with reduced heat of hydration.
6. Reduction of cement content.
7. Placement at night.
8. Cooling coils in the element being constructed.
9. Use of ice as part of the mix water.

1.05 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. The Contractor shall submit detailed, written procedures for the production, transportation, protection, curing, and temperature monitoring of concrete during hot weather. In the submittal, include procedures to be implemented upon abrupt changes in weather conditions or equipment failures. Do not begin hot weather concreting until these procedures have been reviewed by the Engineer and the Owner's Resident Project Representative.
2. Modifications in mix design shall require the approval of the Engineer. No embedding cooling devices may be placed in concrete elements without the approval of the Engineer.

PART 2 : PRODUCTS

2.01 CURING COMPOUNDS

Curing compounds, when their use is permitted for hot weather concreting, shall conform to ASTM C309, Type 2, except as follows: Water loss, when tested in accordance with ASTM C156, shall not exceed 0.39 kg/m2 in 72 hours.

PART 3 : EXECUTION

3.01 CONCRETE TEMPERATURE

The temperature of concrete as delivered at the time and location of placement shall not exceed 100ºF under any conditions. The temperature of concrete as delivered at the time and location of placement under the following combined ambient conditions, except concrete that will be deposited within wall or column forms, shall not exceed the following temperatures:

Relative Humidity Less Than %	Ambient Temperature Greater than °F	Maximum Concrete Temperature °F
80	90	100
70	90	95
60	90	90
50	90	85
40	90	80
30	80	75
20	75	70

3.02 DELIVERY

Concrete shall be placed in the Construction within 45 minutes after the completion of mixing.

3.03 PREPARATION FOR PLACING

Elevated forms and reinforcing steel for beams and similar members shall be cooled by fog spraying and evaporation immediately prior to placing concrete. Forms shall be free of standing water when concrete is placed herein. Cooling water shall be disposed of in accordance with applicable local, state, and federal regulations.

3.04 PLACING

Concrete shall be placed in shallower layers than under normal weather conditions if necessary to assure coverage of the previous layer, while it will respond readily to vibration.

3.05 FINISHING

Fog spray shall be used during finishing operations whenever necessary to avoid surface plastic-shrinkage cracking. Fog spray shall also be used after finishing and before the specified curing is commenced to avoid surface plastic-shrinkage cracking.

3.06 PROTECTION AND CURING

A. Wet cure methods shall be used in accordance with Section 03 30 00 – Cast-In-Place Concrete. Forms shall be kept covered and continuously moist. Once forms are loosened, and during form removal, concrete surfaces shall be protected from drying and shall be kept continuously wet by fog spraying or other approved means.

B. Curing compounds may be used to augment wet cure methods, but shall not be used in lieu of a wet cure.

END OF SECTION

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SECTION 03 60 00
GROUT

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section covers the supply of materials, mixing of materials, and the installation of various grades of grouts utilized in the project, for general purposes.

B. Related Specification sections include but are not necessarily limited to:

1. Section 03 00 00 – Concrete General Requirements.
2. Section 03 11 00 – Concrete Formwork.
3. Section 03 15 00 – Concrete Accessories.
4. Section 03 15 10 – Openings and Penetrations in Construction.
5. Section 03 20 00 – Concrete Reinforcement.
6. Section 03 30 00 – Cast-in-Place Concrete.
7. Section 03 31 10 – Concrete Mixtures.
8. Section 03 31 11 – Cold Weather Concreting.
9. Section 03 31 12 – Hot Weather Concreting.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

B. Standards and Codes: See Section 03 00 00 – Concrete General Requirements for standards referenced in this Section.

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Manufacturer’s data on all products.

PART 2 : PRODUCTS

2.01 EPOXY-RESIN-BASE BONDING SYSTEM

For all grouted pipe penetrations, where called for on the drawings and in all cases where less than a 13-inch thickness of grout or mortar overlays existing concrete or green concrete, a bonding system complying with ASTM C881 shall be used.

2.02 PRECISION GROUT

A. Filling of anchor bolt pockets, handrail pockets, and under equipment and column base plates shall be classified as precision grouting.

B. Grout used for precision grouting shall be a pre-packaged, non-shrink grout using a mixture of metallic and natural aggregates, and shall conform to the most current version of ASTM C1107 Grade B or C when tested at a fluid consistency of 25-30 seconds per ASTM C939 at temperature extremes of 45 and 90°F and an extended working time of 30 minutes.

1. BASF Masterflow 713 Plus or Masterflow 885 are acceptable brand and grout types conforming to this specification.
2. All material used, including water, mixer and pre-packaged grout must be initially within the 45 and 90° limits when testing is initiated.
3. Manufacturer shall provide independent certification of ASTM C1107, compliance without modification of standard methods, and certify that the grout's post-hardening, non-shrink property is not based on gas expansion.

C. Grout shall have strengths of 3000 psi at 3 days, 5000 psi at 7 days, and 7000 psi at 28 days when cured at 72°F, as well as meet the 3-, 7-, and 28-day strengths when tested and cured at the 45 and 90°F limits, and shall not bleed when placed at a fluid consistency.

2.03 PORTLAND CEMENT GROUT

A. Portland Cement Grout shall be used to provide flow concentration in channels, at the bottom of high walls, and in other locations where a general purpose grout is required.

B. Portland cement grout shall be mixed with sand on a ratio of one part cement to two parts sand with an expansive agent included to limit drying shrinkage.

C. Sufficient water shall be added for placement while maintaining a minimum 4,500 psi 28-day compressive strength.

2.04 TOPPING COURSE GROUT

A. This grout shall be used for leveling the bottom of structures.

B. This mix shall contain 6½ sacks of cement per cubic yard of concrete, use sand and 3/8-inch course aggregate, size No. 89 in ASTM C404, and use water-reducing and expansive additives.

C. The minimum compressive strength shall be 4,500 psi in 28 days.

D. Topping grout over floor slabs shall be reinforced with WWR 6x6 W1.4xW1.4.

2.05 RAPID CURE GROUT

A. Rapid cure grout shall be mixed with aggregate as recommended by the manufacturer.

B. The grout shall be BASF MasterEmaco T545 or equal.

C. The minimum compressive strength shall be 4,500 psi in 28 days.

2.06 SELF-LEVELING UNDERLAYMENT

A. Self-leveling cement underlayment shall be Ardex K-15.

B. The compressive strength shall be 4,500 psi per ASTM C109 and shall be capable of feather-edge thickness application.

C. Self-leveling cement underlayment shall be used to level floors where noted on the drawings.

PART 3 : EXECUTION

3.01 MIXING

A. All parts of the respective grouts shall be proportioned by volume measurement.

B. Mixing shall be accomplished using a mechanical mixer suitable to the required quantities.

C. Each batch shall be mixed for not less than 5 minutes.

D. The respective grouts and mortars shall be mixed with sufficient water to maintain the fluidity required while attaining the minimum compressive strength indicated.

3.02 RETEMPERING AND TIME LIMIT

A. Do not retemper or use mortar which has become harsh and non-plastic.

B. When mortar has been maintained plastic and grout fluid, they may be used up to, but not more than, one hour after original mixing.

3.03 TEMPERATURE

Grouting operations shall not commence when the ambient temperature has dropped below 45^{o}F or when the surface to which it is being applied is less than 40^{o}F.

3.04 PROTECTION

All grouting operations shall be protected against moisture intrusion and a sealer, linseed oil or Thoroclear 777, shall be applied at the completion of the work.

3.05 SURFACE PREPARATION

A. The existing concrete surface that the respective grout or mortar shall be placed against shall be cleaned as follows:

1. If the existing surface has been exposed to sludge, chlorine, or other solutions, or was previously painted or treated, the surface shall be sandblasted and steam-cleaned, then treated with a diluted solution of muriatic acid neutralized with an alkaline solution and flushed with clean water.
2. If the existing surface was not exposed to solution other than water, then the surface shall be washed with a diluted (2 parts water to 1 part acid) solution of muriatic acid, neutralized with an alkaline solution, and flushed with clean water.

3.06 PRECISION GROUTING

A. This Section describes additional special provisions for the grouting of anchor bolts, handrail pockets, and column and equipment baseplates, defined herein as precision grouting.

B. All grout used for precision grouting shall be placed in a fluid consistency, with an efflux time of 25 to 30 seconds through a standard flow cone as defined by ASTM C939. The Contractor shall have a standard flow cone on-site to verify grout consistency prior to placement.

C. Contractor shall not mix more grout than can be placed in approximately 10 minutes. Contractor shall not attempt to retemper grout by adding water or remixing after it stiffens.

D. All grout used for filling under column and machinery base plates shall be placed from one side using a form around the grouted area. A beveled form edge shall be provided on one side to help direct the grout flow under the base plate. Do not vibrate grout. Immediately after placement, trim the surfaces with a trowel and cover the exposed grout with clean, wet rags and maintain this moisture for 4 to 6 hours.

E. Forms and excess grout shall be removed after the grout has achieved initial set. The grout should offer stiff resistance to penetration with a pointed mason's trowel prior to removing the grout forms. Exposed shoulders shall be finished and wet cured immediately after form removal, and until grout has reached final set, but not less than 48 hours, followed by two coats of curing compound.

END OF SECTION

SECTION 04 05 13
MASONRY MORTARING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This section includes mortar for masonry.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 04 – Masonry of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

1.	ASTM C91	Standard Specification for Masonry Cement
2.	ASTM C144	Standard Specification of Aggregate for Masonry Mortar
3.	ASTM C150	Standard Specification for Portland Cement
4.	ASTM C207	Standard Specification for Hydrated Lime for Masonry Purposes
5.	ASTM C270	Standard Specification for Mortar for Unit Masonry
6.	ASTM C387	Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar
7.	ASTM C595	Standard Specification for Blended Hydraulic Cements
8.	ASTM C780	Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
9.	ASTM C1142	Standard Specification for Extended Life Mortar for Unit Masonry
10.	ASTM C1180	Standard Terminology of Mortar and Grout for Unit Masonry
11.	ASTM C1329	Standard Specification for Mortar Cement
12.	ACI 530.1	Specification for Masonry Structures
13.	IBC 2018	International Building Code

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Data indicating specifications used for mortar.
2. Test reports for mortar materials, indicating conformance to ASTM C270.

3. Test reports for field sampling and testing mortar in conformance to ASTM C780.
4. Color shall be determined by Owner from standard color chart. Submit a color chart for Owner selection of colored mortar.
5. SAMPLES: Two ribbons of mortar for conformance with color.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver and store manufactured products in original, unopened containers.

B. Store materials in a clean, dry location protected from dampness and freezing.

C. Store cementitious ingredients in weathertight enclosures and protect against contamination and warehouse set.

D. Stockpile and handle aggregates to prevent contamination from foreign materials.

E. Store admixtures to prevent contamination of damage from excessive temperature changes.

F. Keep water clean and free from harmful materials.

1.05 ENVIRONMENTAL REQUIREMENTS

Comply with Section 04 22 00 – Concrete Unit Masonry, 1.05, PROJECT CONDTIONS.

PART 2 : PRODUCTS

2.01 MORTAR MATERIALS

A. CEMENT

1. Portland Cement: ASTM C150, Type I or II
2. Mortar Cement: ASTM C1329, Type S

B. HYDRATED LIME: ASTM C207

C. SAND: ASTM C144

D. ADMIXTURES

1. The use of admixtures shall not be permitted except as specified by the Engineer and as approved by the Building Official.
2. No air entraining admixtures or material containing air entraining admixtures may be used.
3. No antifreeze compounds shall be added to mortar.
4. No admixtures containing chlorides shall be added to mortar.

E. WATER

1. Water shall be clean, potable and free from deleterious quantities of acids, alkalis and organic materials.
2. Water shall come from a domestic supply.

F. MORTAR PIGMENT

1. Mortar pigment shall not exceed 10% of the weight of Portland cement. Mortar shall approximately match color of field block as specified in Section 04 22 00.
2. Carbon black shall not exceed 3% of the weight of Portland cement.

2.02 MORTAR MIXES

MORTAR: ASTM C270, Type S. Proportions shall conform to IBC 2018 Section 2103.2.

PART 3 : EXECUTION

3.01 FIELD MIXING MORTAR

A. Mix cementitious materials and aggregates between 3 and 8 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Do not hand mix mortar. Dry mixes for mortar which have been preblended in a factory shall be mixed at the jobsite until workable, but not to exceed 10 minutes.

B. Control batching procedure to ensure proper proportions by measuring material volume.

C. The consistency of mortar and grout may be adjusted to the satisfaction of the mason by retempering with water.

1. Mortar may be retempered once within 2½ hours after initial mixing to compensate for water lost due to initial evaporation.
2. Retempering shall be done by adding water into a formed basin within the mortar and then working the mortar into the water.
3. Mortar shall not be retempered by splashing water over the surface.

D. Discard all mortar which has begun to stiffen. Also discard mortar if more than 2½ hours old.

3.02 APPLICATION OF MORTAR

A. Ends of solid masonry units shall be buttered with sufficient mortar to fill head joints.

B. Hollow unit masonry shall be mortared so that the head joint thickness is equal to the face shell thickness.

C. Mortar beds for solid units shall be slightly beveled towards the center of the wall so that the bed joints will be sufficiently filled when the masonry unit is brought into line. Furrowing of the joints is not permitted. Bed joints shall include webs as well as faces of the block, so the entire block area is mortared.

D. Closures shall be rocked into placed with mortared head joints against two adjacent bricks in place.

E. Corners and jambs may not be pounded into position to fit stretcher units.

F. Units which have been displaced after the mortar has begun to set shall be cleaned of all mortar and reset with fresh mortar.

G. Mortar fins and protrusions which protrude more than ½ inch into cells or spaces to be grouted are to be avoided.

H. Mortar joints shall be tooled as directed in Section 04 22 00 – Concrete Unit Masonry.

END OF SECTION

SECTION 04 05 16
MASONRY GROUTING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes grout for masonry.

B. Related Specification sections include but are not necessarily limited to:

1. Section 04 05 13 – Masonry Mortaring.
2. Section 04 22 00 – Concrete Unit Masonry.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 04 – Masonry of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

1.	ASTM C150	Standard Specification for Portland Cement
2.	ASTM C207	Standard Specification for Hydrated Lime for Masonry Purposes
3.	ASTM C387	Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete
4.	ASTM C404	Standard Specification for Aggregates for Masonry Grout
5.	ASTM C476	Standard Specification for Grout for Masonry
6.	ASTM C595M	Standard Specification for Blended Hydraulic Cements
7.	ASTM C1019	Standard Test Method for Sampling and Testing Grout
8.	ACI 530.1	Specification for Masonry Structures

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Test reports for grout materials, indicating conformance to ASTM C476.
2. Test reports for field sampling and testing grout in conformance to ASTM C1019.

1.04 DELIVERY, STORAGE AND HANDLING

A. Grout may be plant-batched and shipped to project in ready-mix trucks, or grout may be mixed at project site.

B. Deliver and store manufactured products in original, unopened containers.

C. Store materials in a clean, dry location protected from dampness and freezing.

D. Store cementitious ingredients in weathertight enclosures and protect against contamination and warehouse set.

E. Stockpile and handle aggregates to prevent contamination from foreign materials.

F. Store admixtures to prevent contamination of damage from excessive temperature changes.

G. Keep water clean and free from harmful materials.

1.05 ENVIRONMENTAL REQUIREMENTS

Comply with Section 04 22 00 – Concrete Unity Masonry, 1.05, PROJECT CONDTIONS.

PART 2 : PRODUCTS

2.01 GROUT MATERIALS

A. PORTLAND CEMENT: ASTM C150 Type I or II.

B. HYDRATED LIME: ASTM C207.

C. AGGREGATE: ASTM C404.

D. ADMIXTURES

1. The use of admixtures shall not be permitted except as specified by the Engineer and as approved by the Building Official.
2. An admixture shall be used in high lift grouting to counteract water loss and volume reduction.

E. WATER

1. Water shall be clean, potable and free from deleterious quantities of acids, alkalis and organic materials.
2. Water shall come from a domestic supply.

2.02 GROUT MIXES

A. GROUT: ASTM C476

1. Fine Grout. (1 part Portland cement; 2¼ to 3 parts sand).
2. Coarse Grout. (1 part Portland cement; 2¼ to 3 parts sand; 1 to 2 parts gravel). Maximum aggregate size 3/8 inch.
3. Slump. 7 to 11 inches.

4. Minimum Strength. 2,000 psi.

PART 3 : EXECUTION

3.01 FIELD MIXING GROUT

A. All cementitious materials and aggregate shall be mixed a minimum of 5 minutes in a mechanical mixer with sufficient water to produce a spreadable, workable consistency. Dry mixes for grout which have been preblended in a factory shall be mixed at the jobsite until workable, but not to exceed 10 minutes.

B. Control batching procedure to ensure proper proportions by measuring material volume.

C. The consistency of grout may be adjusted to the satisfaction of the mason by retempering with water.

D. Discard all grout which has begun to harden. Also discard grout if more than 1½ hours old.

3.02 GROUT PLACEMENT – GENERAL

A. PLACING TIME: Place grout within 1½ hours from introducing water in the mixture and prior to initial set.

B. CONFINEMENT: Confine grout to the areas indicated on the Project Drawings. Use material to confine grout that permits bond between masonry units and mortar.

C. GROUT POUR HEIGHT: Do not exceed the maximum grout pour height given in the table below.

Grout Space Requirements			
Grout Type	**Maximum Grout Pour Height, ft.**	**Minimum Width of Grout Space,[1,2] in.**	**Minimum Grout Space Dimensions for Grouting Cells of Hollow Units, in. x in.**
Fine	1	3/4	1½ x 2
Fine	5	2	2 x 3
Fine	12	2½	2½ x 3
Fine	24	3	3 x 3
Coarse	1	1½	1½ x 3
Coarse	5	2	2½ x 3
Coarse	12	2½	3 x 3
Coarse	24	3	3 x 4

Notes:
1) For grouting between masonry wythes.
2) Grout space dimension is the clear dimension between any masonry protrusion and shall be increased by the diameters of the horizontal bars within the cross section of the grout space.

D. GROUT LIFT HEIGHT: Where the following conditions are met, place grout in lifts not exceeding 12.67 ft. Otherwise, place grout in lifts not exceeding 5 ft.

1. The masonry has cured for at least 4 hours.
2. The grout slump is maintained between 10 and 11 in.
3. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.

E. CONSOLIDATION: Consolidate grout at the time of placement.

1. Consolidate grout pours 12 in. or less in height by mechanical vibration or by puddling.
2. Consolidate pours exceeding 12 in. in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

F. ALTERNATE GROUT PLACEMENT: Place masonry units and grout using construction procedures employed in the accepted grout demonstration panel.

G. HORIZONTAL JOINTS: Between grout pours, a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with the grout stopping a minimum of 1½ inches below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be stopped a minimum of 1/2 inch below the top of the masonry.

3.03 LOW LIFT GROUTING

A. GROUT POURS 12 INCHES AND LESS

1. If necessary, clean or roughen concrete foundation by sandblasting, chipping, or other means to remove laitance.
2. Lay one course of masonry, making sure no mortar extends into grout spaces.
3. Place all reinforcement which extends into grouted areas. Reinforcement shall be secured prior to grouting.
4. Grout to below one-half of the top unit height and consolidate by puddling to eliminate voids in the grout.
5. Lay an additional 12 inches of masonry units.
6. Grout each 12 inches as the units are laid. Hold the top of each grout pour approximately 1½ inches below the top of the wall. Provide at least ½ inch of grout cover above horizontal reinforcing steel.
7. At the completion of each wall, grout flush to the top of the units.
8. Remove all grout droppings as the work progresses.

B. GROUT POURS MORE THAN 12 INCHES AND UP TO 5 FEET

1. Construct the masonry wall up to 5 feet above the foundation. Install all reinforcing steel, anchors, and embedded items as masonry work progresses.
2. For two wythe walls, bond the wythes together with rectangular ties or joint reinforcing so that one cross-wire secures approximately 2 square feet of wall.
3. For walls that are to be partially grouted, use expanded metal mesh or other material which will not interfere with bond to restrict the grout into only those cells which are to be grouted.
4. After the mortar joints have set, grout the wall to 1½ inches below the top of the wall. Where bond beams occur, stop grout pour a minimum of ½ inch below top of masonry.
5. Consolidate the grout using a mechanical vibrator and reconsolidate after the excess water is absorbed into the masonry units.
6. Continue to lay up masonry and reinforcing steel, up to 5 feet at a time. After the mortar has set, grout and consolidate.
7. At the completion of the wall, fill the grout space flush with the top of the units and consolidate.

3.04 HIGH LIFT GROUTING

A. Construct the masonry wall up to a maximum of 24 feet above the foundation. Provide cleanout openings at the base of the wall at all vertical reinforcing bars, but at a spacing no more than 32 inches on centers for solid grouted walls or a maximum of 48 inches on centers for partially grouted walls.

B. Install horizontal reinforcing steel, anchors, and embedded items as masonry work progresses. Vertical reinforcing steel may be placed after the wall is constructed, provided it is supported every 200 bar diameters with wire positioners or other devices to hold it in place. All reinforcement must be in place prior to grouting.

C. For two wythe walls, bond the wythes together with rectangular ties or joint reinforcing so that one cross-wire secures approximately 2 square feet of wall.

D. Install vertical grout dams at a maximum horizontal spacing of 30 feet to control the horizontal flow of grout.

E. For walls that are to be partially grouted, use expanded metal lath mesh or other material which will not interfere with bond to restrict the grout into only those cells which are to be grouted.

F. After the mortar joints have set, remove protruding mortar fins which excessively constrict the grout space. Remove all such droppings and debris through the cleanouts at the base of the wall.

G. After the cleanouts have been inspected, seal and brace the cleanouts.

H. Grout the walls in 6-foot maximum lifts. All cells and spaces containing reinforcing steel shall be solidly grouted for partially grouted walls. For solid grouted walls, all cells shall be grouted.

I. Consolidate the grout using a mechanical vibrator and reconsolidate after the excess water is absorbed into the masonry units.

J. Stop the grout 1½ inches below the top of the uppermost grouted unit if the grouting is to be stopped for more than one hour.

K. Continue to grout the wall in 6-foot lifts, consolidating and reconsolidating each lift.

L. Where additional masonry is to be laid above this point, stop the group 1½ inches below the top of the masonry units. Otherwise, fill the grout space flush with the top of the units at the top of the wall and consolidate.

3.05 MECHANICAL VIBRATION

Grouted hollow unit masonry must be consolidated by mechanical vibration during placing of grout and reconsolidated by mechanical vibration to minimize voids due to water loss.

END OF SECTION

SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section covers furnishing and installing integrally colored, concrete masonry units, mortar, grout and reinforcing steel in the masonry. Provide equipment necessary for their installation. Construction shall conform to IBC 2018 Section 2104, ACI 530.1, and these specifications. In case of conflicting provisions, the more restrictive provisions shall apply unless otherwise approved by the Engineer.

B. Related Specification sections include but are not necessarily limited to:

1. Section 04 05 13 – Masonry Mortaring.
2. Section 04 05 16 – Masonry Grouting.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 04 – Masonry of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1.	ACI 530.1	Specification for Masonry Structures
2.	A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3.	ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
4.	ASTM C90	Standard Specification for Loadbearing Concrete Masonry Units
5.	ASTM E514	Standard Test Method for Water Penetration and Leakage Through Masonry
6.	AWS D1.4	Structural Welding Code-Reinforcing Steel
7.	IBC 2018	2018 International Building Code

1.03 SUBMITTALS

A. Submit under provisions of the WSDOT Division 1 Special Provisions as follows:

1. Color shall be determined by Owner from standard color chart. Submit a color chart for Owner selection of colored block.
2. SAMPLES: Two blocks of concrete masonry units of each color selected by Owner for conformance with color.
3. Submit shop drawings for reinforcing steel.

4. Manufacturer's certification that masonry units provided meet or exceed the requirements of this specification.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store masonry units above ground to prevent contamination by mud, dust, or other materials likely to cause staining or other defects.

B. Cover and protect masonry units from inclement weather to maintain quality control and physical requirements. Prevent wetting of units prior to use.

C. Do not use damaged masonry units, damaged components, or damaged packaged material. Do not use masonry materials that are contaminated.

1.05 PROJECT CONDITIONS

A. CONSTRUCTION LOADS: Do not apply construction loads that exceed the safe superimposed load-carrying capacity of the masonry and shores, if used.

B. MASONRY PROTECTION: Cover top of unfinished masonry work to protect it from the weather.

C. COLD WEATHER CONSTRUCTION: When ambient air temperature is below 40°F implement cold weather procedures and comply with the following:

1. Do not lay glass unit masonry.
2. Preparation. Comply with the following requirements prior to conducting masonry work:
    a. Do not lay masonry units having either a temperature below 20°F or containing frozen mixture, visible ice, or snow on their surface.
    b. Remove visible ice and snow from the top surface of existing foundations and masonry to receive new construction. Heat these surfaces above freezing, using methods that do not result in damage.
3. Construction: These requirements apply to work in progress and are based on ambient air temperature. Do not heat water or aggregates used in mortar or grout above 140°F. Comply with the following requirements during construction during the following ambient air conditions:
    a. 40°F to 32°F: Heat sand or mixing water to produce mortar temperature between 40°F and 120°F at the time of mixing. Heat grout materials when the temperature of the materials is below 32°F.
    b. 32°F to 25°F: Heat sand and mixing water to produce mortar temperature between 40°F and 120°F at the time of mixing. Maintain mortar temperature above freezing until used in masonry. Heat grout aggregates and mixing water to produce grout temperature between 70°F and 120°F at the time of mixing. Maintain grout temperature above 70°F at the time of grout placement. Heat AAC units to a minimum temperature of 40°F before installing thin-bed mortar.

c. 25°F to 20°F. Comply with preceding paragraph and heat masonry surfaces under construction to 40°F. Use wind breaks or enclosures when the wind velocity exceeds 15 mph. Heat masonry to a minimum of 40°F prior to grouting.

d. 20°F and below: Comply with the preceding paragraph and provide an enclosure and auxiliary heat to maintain air temperature above 32°F within the enclosure.

4. Protection: These requirements apply after masonry is placed and are based on anticipated minimum daily temperature for grouted masonry and anticipated mean daily temperature for un-grouted masonry. Protect completed masonry in the following manner:

a. Maintain the temperature of glass unit masonry above 40°F for the first 48 hours after construction.

b. Maintain the temperature of AAC masonry above 32°F for the first 4 hours after thin-bed mortar application.

c. 40°F to 25°F. Protect newly constructed masonry by covering with weather-resistive membrane for 24 hours after being completed.

d. 25°F to 20°F: Cover newly constructed masonry completely with weather-resistive insulating blankets, or equal protection, for 24 hours after completion of work. Extend time period to 48 hours for grouted masonry, unless the only cement in the grout is Type III Portland cement.

e. 20°F and below: Maintain newly constructed masonry temperature above 32°F for at least 24 hours after being completed by using heated enclosures, electric heating blankets, infrared lamps, or other acceptable methods. Extend time period to 48 hours for grouted masonry, unless the only cement in the grout is Type III Portland cement.

D. HOT WEATHER CONSTRUCTION: Implement approved hot weather procedures and comply with the following provisions:

1. Preparation. Prior to conducting masonry work:

a. When the ambient air temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph:

1) Maintain sand piles in a damp, loose condition.

2) Provide necessary conditions and equipment to produce mortar having a temperature below 120°F.

b. When the ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph, implement the requirements of the preceding paragraph and shade materials and mixing equipment from direct sunlight.

2. Construction. While masonry work is in progress:

   a. When the ambient air temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph:

      1) Maintain temperature of mortar and grout below 120°F.

      2) Flush mixer, mortar transport container, and mortar boards with cool water before they come into contact with mortar ingredients or mortar.

      3) Maintain mortar consistency by retempering with cool water.

      4) Use mortar within 2 hours of initial mixing.

   b. When the ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph implement the requirements of the preceding paragraph and use cool mixing water for mortar and grout. Ice is permitted in the mixing water prior to use. Do not permit ice in the mixing water when added to the other mortar or grout materials.

3. Protection: When the mean daily temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph, fog spray newly constructed masonry until damp, at least three times a day until the masonry is three days old.

PART 2 : PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. HOLLOW LOAD-BEARING CONCRETE MASONRY UNITS

1. ASTM C90, Specifications for Load-Bearing Concrete Masonry Units. Units shall be as manufactured by Mutual Materials Co., or approved equal. Smooth-Face or Ground-Face Finish, nominal 8 high and 8 wide 16 long. See Architectural Elevations for locations of each finish.

2. Finish and Appearance of Visible Masonry Units. Where units are to be used in exposed wall construction, the face or faces that are exposed shall not show chips or cracks, or other imperfections, when viewed from a distance of 20 feet at right angles to the wall, as judged by the Engineer.

3. Masonry shapes, sizes, and finish types vary and shall be installed as appearance indicated and as required for a complete finished construction. All exposed faces to be finished per finish type.

4. Net Area Compressive Strength of the Units. 2,800 psi.

5. Provide medium weight units.

B. CONCRETE MASONRY UNIT ADMIXTURES

1. Manufacturer. "Dry-Block" block admixture by GCP Applied Technologies. Follow manufacturer's published recommendations for preparation and use.

2.02 MORTAR

A. Mortar shall conform to Section 04 05 13 – Masonry Mortaring.

B. MORTAR ADMIXTURES

1. Integral Water Repellent Admixture. An integral liquid polymeric admixture manufactured specifically for use in a mortar mix, which cross links and becomes permanently locked into mortar to provide resistance to water penetration. Test in accordance with ASTM E514, with the test period extended to 72 hours, achieving a Class E (excellent) using the rating criteria specified in ASTM E514-74.

2. Manufacturer. "Dry-Block" mortar admixture by GCP Applied Technologies. Follow manufacturer's published recommendations for preparation and use.

2.03 GROUT

Grout shall conform to Section 04 05 16 – Masonry Grouting.

2.04 REINFORCING STEEL

A. Steel reinforcing shall conform to ASTM A615, Grade 60, deformed bars.

B. All steel shall be detailed, fabricated and supplied, as shown on the Drawings.

C. Vertical steel in concrete block construction may be furnished in partial lengths with approved laps.

D. Reinforcing bar hooks shall be fabricated in accordance with ACI 530.1, Section 2.7.

E. Reinforcement shall be clean and free from loose rust, scale, dirt and any other coatings that may reduce bond.

F. METAL TIES AND ANCHORS: Metal ties and anchors shall meet the requirements of ACI 530.1 Section 2.4D.

G. COATINGS: Reinforcement shall be clean at the time of installation, as hereinafter specified, and shall be uncoated.

2.05 MASONRY WATER REPELLENT AND SEALER

A. All concrete masonry units shall be manufactured with integral water repellent additive during production, "Dry-Block" block admixture by GCP Applied Technologies.

B. Field applied unit masonry sealer shall be a clear siloxane sealer with an active solids content of 6.5%, Fabrishield #653 by Fabrikem Chemicals International or equal.

2.06 GRAFFITI REPELLENT – EXTERIOR CONCRETE UNIT MASONRY

A. Blok-Guard® & Graffiti Control II, PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046 or equal.

B. Defacer Eraser® Graffiti Wipe, PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. or equal.

1. Provide 2 gallons of material to owner.

PART 3 : EXECUTION

3.01 PREPARATION

A. MATERIALS

1. Masonry materials at the job site shall be stored off the ground to ensure they are kept clean and protected from the elements.
2. All masonry units shall be sound, free of cracks or other defects that would interfere with the proper placing of the unit or impair the strength of construction. Minor cracks incidental to the usual method of manufacture or minor chipping resulting from customary method of handling and shipping and delivery shall not be deemed grounds for rejection.
3. Reinforcing bars shall be free of kinks or bends, except for bends detailed on the Drawings. Remove any loose rust, ice, oils and other deleterious coatings from the reinforcing steel.

B. LAYOUT AND FOUNDATION

1. Masonry work shall not begin until layout is approved by Owner.
2. Foundation shall be level and at correct grade so that the initial bed joint shall not be less than ¼ inch, nor more than 1 inch thick.
3. Surface of foundation shall be clean and free of laitance and other deleterious materials. Foundation surface shall be roughened to a full amplitude of 1/16 inch.
4. When a foundation dowel does not align with a vertical cell, it may be bent to a slope of not more than 1 inch horizontally to 6 inches vertically. Remove dowels which do not align properly and replace with new bars of equal capacity.

C. CLEANOUTS: Provide cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds 5 ft.

1. Construct cleanouts so that the space to be grouted can be cleaned and inspected. In solid grouted masonry, space cleanouts horizontally a maximum of 32 in. on center.

2. Construct cleanouts with an opening of sufficient size to permit removal of debris. The minimum opening dimensions shall be 3 in.

3. After cleaning, close cleanouts with closures braced to resist grout pressure.

3.02 INSTALLATION OF MASONRY UNITS

A. GENERAL

1. All masonry units shall be laid true, level, plumb and in uniform coursing in accordance with the Drawings.

2. All corners and angles shall be square unless otherwise indicated on the Drawings.

3. Unless otherwise specified or shown on the Drawings, units shall be laid in running bond.

4. Use masonry saws to cut and fit masonry units.

5. Lay only dry concrete masonry units. Concrete masonry units shall not be wetted unless otherwise approved. Wet cutting is permitted.

6. Adjust masonry units into final position while mortar is soft and plastic. If units are displaced after mortar has stiffened, remove the mortar, clean the joints and units, and relay the units with fresh mortar.

B. PROTECTION OF WORK

1. Protect masonry surfaces from mortar and grout droppings. Any mortar or grout which comes in contact with exposed masonry shall be cleaned immediately to prevent staining.

2. Cover the top of partially completed walls at all times when work is not in progress. Extend covers a minimum of 2 feet down both sides of the wall and securely hold the cover in place. Provide additional protection of the masonry work as required in this specification for extreme weather conditions.

C. PLACING MORTAR AND UNITS

1. Bed and head joints. Unless otherwise required, construct 3/8-in. thick bed and head joints, except at foundation or with glass unit masonry. Construct bed joint of the starting course of foundation with a thickness not less than ¼-in. and not more than ¾ in. Provide glass unit masonry bed and head joint thickness in accordance with paragraph 5c below. Construct joints shall also conform to the following:

   a. Fill holes not specified in exposed and below grade masonry with mortar.

   b. Unless otherwise required, tool joint with a round jointer when the mortar is thumbprint hard.

   c. Remove masonry protrusions extending ½-in. or more into cells or cavities to be grouted.

2. Collar joints. Unless otherwise required, solidly fill collar joints less than ¾-in wide with mortar as the job progresses.

3. Hollow units. Place hollow units so:

   a. Face shells and webs of bed joints are fully mortared.

   b. Head joints are mortared, a minimum distance from each face equal to the face shell thickness of the unit.

   c. Vertical cells to be grouted are aligned and unobstructed openings for grout are provided in accordance with the Project Drawings.

   d. Place clean units while the mortar is soft and plastic. Remove and re-lay in fresh mortar any unit disturbed to the extent that initial bond is broken after initial positioning.

   e. Cut exposed edges or faces of masonry units smooth, or position so that exposed faces or edges are unaltered manufactured surfaces.

   f. When the bearing of a masonry wythe on its support is less than two-thirds of the wythe thickness, notify the Engineer.

4. Mortar joints shall be straight, clean and uniform in thickness.

5. Provide tooled concave mortar joints for all masonry unless otherwise specified. Walls which are to be plastered shall have flush cut or sacked mortar joints.

6. Unless otherwise specified or noted on the Drawings, all mortar joints shall be tooled with a concave surface. Tooling shall be done when the mortar is partially set but still sufficiently plastic to bond. All tooling shall be done with a tool that compacts the mortar.

7. If it is necessary to remove a unit after it has been set in place, the unit shall be removed from the wall, cleaned and set in fresh mortar.

8. Control joints shall be placed and constructed as shown on the Contract Drawings. Keep these joints clean from mortar drippings and other debris.

3.03 EMBEDDED ITEMS AND ACCESSORIES

A. Construct chases as masonry units are laid.

B. Install pipes and conduits passing horizontally through nonbearing masonry partitions.

C. Place sleeves, pipes and conduits passing horizontally through walls, piers, pilasters, or columns.

D. Place horizontal pipes and conduits in and parallel to plane of walls.

E. Install and secure connectors, flashing, weep holes, weep vents, nailing blocks, and other accessories.

F. Install movement joints.

G. Do not embed aluminum conduits, pipes, and accessories in masonry, grout, or mortar, unless effectively coated or covered to prevent chemical reaction between aluminum and cement or electrolytic action between aluminum and steel.

3.04 BRACING OF MASONRY

Design, provide, and install bracing that will assure stability of masonry during construction.

3.05 SITE TOLERANCES

A. Erect masonry within the following tolerances from the specified dimensions.

Dimension of Elements	
In cross section or elevation	-1/4 in, +1/2 in.
Mortar joint thickness Bed Head Collar Glass unit masonry	 ±1/8in. -1/4 in., +3/8 in. -1/4 in., +3/8 in. see 3.02C5c
Grout space or cavity width, except for masonry walls passing framed construction	-1/4 in., +3/8 in.

Elements	
Variation from level Bed joints Top surface of bearing walls	±1/4 in. in 10 ft., ±1/2 in. maximum -±1/4 in. in 10 ft., ±1/2 in. maximum
Variation from plumb	±1/4 in. in 10 ft., 3/8 in. in 20 ft., ±1/2 in. maximum
True to a line	±1/4 in. in 10 ft., ±3/8 in. in 20 ft., ±1/2 in. maximum
Alignment of columns and walls (bottom versus top)	±1/2 in. in 10 ft., ±3/4 in. maximum

Location of Elements	
Indicated in plan	±1/2 in. in 20 ft ±3/4 in. maximum
Indicated in elevation	±1/4 in. in story height ±3/4 in. maximum

B. If the above conditions cannot be met due to previous construction, notify the Engineer.

3.06 REINFORCEMENT, TIE, AND ANCHOR INSTALLATION

A. BASIC REQUIREMENTS: Place reinforcement, wall ties, and anchors in accordance with the sizes, types, and locations indicated on the Project Drawings and as specified. Do not place dissimilar metals in contact with each other.

B. REINFORCEMENT

1. Support and fasten reinforcement together to prevent displacement beyond the tolerances allowed by construction loads or by placement of grout or mortar.
2. Completely embed reinforcing bars in grout.
3. Maintain clear distance between reinforcing bars and any face of masonry unit or formed surface, but not less than ¼ in. for fine grout or ½ in. for coarse grout.
4. Splice only where indicated on the Project Drawings, unless otherwise acceptable. When splicing by welding, provide welds in conformance with the provisions of AWS D1.4.
5. Unless accepted by the Engineer, do not bend reinforcement after it is embedded in grout or mortar.
6. Placement tolerances
   a. Tolerances for the placement of steel in walls and flexural elements shall be ±1/2 in. when the distance from the centerline of steel to the opposite face of masonry, d, is equal to 8 in. or less, ±1 in. for d equal to 24 in. or less but greater than 8 in., and ±1¼ in. for d greater than 24 in.
   b. Place vertical bars within 2 in. of the required location along the length of the wall.
   c. If it is necessary to move bars more than one bar diameter or a distance exceeding the tolerance stated above to avoid interference with other reinforcing steel, conduits, or embedded items, notify the Engineer for acceptance of the resulting arrangement of bars.

C. POSITIONERS: Reinforcement shall be held securely and properly in position. Steel in the grout spaces must be held in position by wiring or positioners spaced at not more than 200 times the bar diameters. Where these positioners are within ½ inch of the surface of the masonry, they shall be galvanized according to ASTM Standard A153.

D. Unless otherwise dimensioned on the Contract Drawings, vertical reinforcement shall be positioned midway between the faces of the masonry unit.

3.07 GROUTING

Masonry work shall be grouted as noted on the Contract Drawings and Section 04 05 16 – Masonry Grouting.

3.08 POINTING AND CLEANING

A. Point and tool any holes in mortar joints to produce a uniform, tight joint.

B. Cement, mortar and grout stains shall be removed immediately from all surfaces.

C. At the conclusion of masonry work, remove scaffolding and equipment used in the work, along with debris, refuse and surplus masonry materials from the premises.

3.09 MASONRY SEALER

A. Exterior concrete masonry units shall receive a clear water repellent sealer installed over cleaned surfaces in accordance with manufacturer's recommendations. Coating shall extend from masonry sill cap down to top of concrete footing.

B. Unless a different finish system is indicated on the Plans, interior concrete masonry units shall receive sealer from top of concrete footing to the top of exposed masonry.

C. The repellent shall be applied in two separate coats, allowing a minimum dry time of 12 hours, with repellent applied at the rate of 50 square feet per gallon for each coat.

3.10 GRAFFITI REPELLENT

A. APPLICATION

1. Apply in conformance with the Manufacture's Product Data Sheet and standard application requirements. Do not dilute or alter. Apply to a visibly dry and absorbent surface.

B. SPRAY

1. Saturate from the bottom up.
2. Let the first application penetrate for 2-3 minutes. Re-saturate. Less will be needed for the second application.

C. BRUSH OR ROLLER

1. Saturate uniformly.
2. Allow to penetrate for 2-3 minutes. Re-saturate.
3. Brush out heavy runs and drips that don't penetrate.

D. DENSE, SMOOTH SURFACE APPLICATION INSTRUCTIONS

1. Apply a single coat. Use sufficient coverage to completely wet the surface without creating drips, puddles or rundown. DO NOT OVER APPLY.
2. Test for application rate.

E. POROUS SURFACE APPLICATION INSTRUCTIONS

1. Apply second coat as soon as the first application is dry to the touch or within one hour.
2. Protect surfaces from rainfall for 6 hours following treatment.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

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

B. Related Specification sections include but are not necessarily limited to:

1. Section 09 91 13 – Building Exterior Painting.
2. Section 09 91 23 – Building Interior Painting.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 06 – Wood, Plastics and Composites of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

1. American Institute of Steel Construction,
   a. "Code of Standard Practice for Steel Buildings and Bridges", 2005, excluding:
      1) Section 4.4 Approval
      2) Section 7 Erection, and
      3) Section 9 Contracts.
2. Research Council on Structural Connections
   a. Specification for Structural Joints Using ASTM A325 or A490 Bolts
3. American National Standards Institute (ANSI):
   a. A14.3, American National Standards for Ladders - Fixed - Safety Requirements.
4. American Welding Society Standards
   a. A5.9 Bare Stainless Steel Welding Electrodes & Rods
   b. D1.1 Structural Welding Code - Steel
   c. D1.2 Structural Welding Code – Aluminum
   d. D10.4-86R Recommended Practices for Welding Austenitic Chromium Nickel Stainless Steel Piping and Tubing

5. ASTM Standards

a.	A6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
b.	A36	Standard Specification for Carbon Structural Steel
c.	A47	Standard Specification for Ferritic Malleable Iron Castings
d.	A48	Standard Specification for Gray Iron Castings
e.	A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
f.	A90	Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
g.	A108	Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished
h.	A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
i.	A143	Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
j.	A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
k.	A194	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
l.	A269	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
m.	A276	Standard Specification for Stainless Steel Bars and Shapes
n.	A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
o.	A312	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
p.	A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
q.	A384	Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
r.	A385	Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

s.	A500	Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
t.	A501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
u.	A536	Standard Specification for Ductile Iron Castings
v.	A554	Standard Specification for Welded Stainless Steel Mechanical Tubing
w.	A563	Standard Specification for Carbon and Alloy Steel Nuts
x.	A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
y.	A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
z.	A668	Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
aa.	A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
bb.	A786	Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
cc.	A967	Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts
dd.	A992	Standard Specification for Structural Steel Shapes
ee.	A1011	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
ff.	A1064	Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
gg.	B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
hh.	B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ii.	F467	Standard Specification for Nonferrous Nuts for General Use
jj.	F468	Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use
kk.	F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

ll.	F594	Standard Specification for Stainless Steel Nuts
mm.	F835	Standard Specification for Alloy Steel Socket Button and Flat Countersunk Head Cap Screws
nn.	F879	Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws
oo.	F959	Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
pp.	F1554	Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
qq.	F1789	Standard Terminology for F16 Mechanical Fasteners
rr.	F2329	Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
ss.	F3125	Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Complete detail drawings of all steel framing and miscellaneous metal items specified herein or shown on the plans.
2. Certifications of conformance to specifications for nuts and bolts.
3. Certification of conformance with ASTM A380 for handling and cleaning of stainless steel.
4. Welder AWS certifications.
5. Material data and certification for steels and weld electrodes.
6. Product data for manufactured items.
7. Manufacturer's installation instructions.
8. Provide manufacturer's standard allowable load tables for the following:
    a. Grating and checkered plate.
    b. Expansion anchor bolts.
    c. Adhesive anchor bolts.
9. Contractor designed systems and components, including but not limited to, landings and ladders:
    a. Certification that manufactured units meet all design loads specified.

b. Shop Drawings and engineering design calculations:

1) Indicate design live loads.

2) Sealed by a professional structural engineer.

3) Engineer will review for general compliance with Contract Documents.

1.04 DEFINITIONS

A. FASTENERS: As defined in ASTM F1789.

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. HARDWARE: As defined in ASTM A153.

D. INSTALLER OR APPLICATOR

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.

2. Installer and applicator are synonymous.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle fabrications to avoid damage.

B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

PART 2 : PRODUCTS

2.01 GENERAL MATERIALS

A. STRUCTURAL STEEL: ASTM A36 (rolled shapes other than wide flange shapes), ASTM A500 Grade B (tubing), ASTM A53, Grade B (pipe), ASTM A6 (general requirements).

1. Filler metal strength for welding shall be not less than 70 ksi, low hydrogen type.

2. Wide flange shapes and structural tee sections fabricated from wide flange shapes shall be ASTM A992.

3. Structural tee sections shall be straightened after cutting if necessary to meet the tolerances of ASTM A6.

B. MISCELLANEOUS CARBON STEEL SHEET AND STRIP: ASTM A1011, “Structural Quality,” Grade 36 or better.

C. ALUMINUM: ASTM B209 or B221, type 6061 or 6063.

1. Welding shall be with an inert gas shielded arc or resistance welding process.

2. No welding process that requires a welding flux shall be used.

3. Weld filler shall conform to type recommended by AWS D1.2 for the alloys joined.

D. STAINLESS STEEL: ASTM A666, type 304 or 316. Use 304L or 316L for shapes to be welded.

1. Filler metals for welding shall be 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.

2. Molybdenum content of filler metal shall be not less than 6 percent.

E. IRON

1. Ductile iron: ASTM A536.

2. Gray cast iron: ASTM A48 (minimum 30,000 psi tensile strength).

3. Malleable iron: ASTM A47, ASTM A197.

F. BOLTS, WASHERS, AND NUTS: Bolts, washer, and nuts shall meet the requirements of the following specifications:

1. Anchor bolts. All anchor bolts, nuts and washers shall be either hot-dip galvanized or stainless steel as called out on the drawings or specified. Where not indicated on drawings or in specifications, stainless steel shall be used in all hydraulic structures or buried applications. Galvanized anchor bolts shall conform to ASTM F1554, Grade 36 or Grade 55, with ASTM A563 or A194 nuts. Anchor bolts shall be headed stud type “L”. “J” type bolts shall not be used.

2. Expansion bolts. Bolts, nuts, and washers shall be 316 stainless steel; wedges shall be double plated spring steel.

3. 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 unless noted otherwise.

4. High strength bolts. ASTM F3125 Grade 325. Hot dip galvanized unless noted otherwise. Pre-tension using ASTM F959 direct tension indicators. ASTM A563 nuts.

5. Special requirements for galvanized nuts and bolts. Galvanized nuts and bolts shall be furnished by a single supplier and shall use the same galvanizing process. Nuts shall come coated with a visible dye lubricant. Galvanized nuts shall be color coded to distinguish nuts that are hot dipped from mechanically galvanized material.

6. Stainless steel bolts and nuts. Stainless steel bolts shall conform to ASTM F593. Stainless steel nuts shall conform to ASTM F594. Bolts and nuts to be Alloy Group 1 or 2, Condition CW1 if 5/8” or less, otherwise CW2.

7. Washers shall be the same material and alloy as found in accompanying bolts and nuts.

G. METAL TYPE: Unless otherwise specified or noted on the plans, metal fabrications exposed to potable water or sewage, shall be 316/316L stainless steel. All carbon steel fabrications shall be galvanized, unless otherwise specified or noted on the Plans.

2.02 FABRICATION

A. FABRICATION-GENERAL

1. Workmanship. Conform to accepted shop practices.
    a. Form work true to detail, with clean, straight, sharply defined profiles.
    b. Unless otherwise shown or specified, finish exposed welds flush and smooth.
2. Joints and Connections. Weld all joints, unless other fastening methods are shown, specified, or specifically approved.
    a. Close fit exposed joints; make joints where least conspicuous.
    b. Unless otherwise shown or specified, use flat and countersunk headed bolts or screws in exposed connections.
3. Cutting, Drilling. Perform coping, cutting, drilling and punching required for accurate fitting and assembly work.
    a. 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.
    b. 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.
4. 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.
5. Dissimilar Materials Protection. Insulate aluminum surfaces in contact with plaster, concrete, or metals other than galvanized or stainless steel. See General Structural Notes for coating requirements.
6. Workmanship. Fabricate all items neatly and rigidly in accordance with the details.
    a. Form curved metal neatly to radii indicated.
    b. Provide members of sizes indicated and weld, bolt or rivet securely together.
    c. Furnish bolts, nuts, washers, and other fastening devices required for anchoring and securing work.

7. Welding. Use electric shielded-arc process in accordance with Welding Specifications of American Welding Society.

    a. Use only welding operators properly trained, highly skilled, and AWS-certified in arc welding.

    b. Grind smooth all surface welds exposed to view.

B. SPECIAL REQUIREMENTS FOR STAINLESS STEEL FABRICATIONS

1. Welds and joint areas shall be cleaned before and after welding in accordance with gross inspection requirements of ASTM A380.

2. Observe precautions against contamination with free iron and protection of cleaned surfaces in accordance with ASTM A380.

C. Fabricate grating, checkered plate, stairs, ladders, and accessories using galvanized steel unless shown otherwise on Drawings:

1. Finish:

    a. Mill, unless noted otherwise.

    b. Coat surfaces in contact with dissimilar materials.

2.03 HOT-DIP GALVANIZING

A. Steel items called out on the drawings or specified herein, as galvanized, or hot-dip galvanized shall be hot-dip coated in accordance with one or more of the following, as is applicable:

Reference	Title
ASTM A90	Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A143	Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A384	Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
ASTM A385	Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
MILSPEC DOD-P-21035	Paint, High Zinc Dust Content, Galvanizing Repair

2.04 LADDER

A. Fabricate vertical ladder conforming to 29 CFR 1910.27 except as follows.

1. Minimum design load shall be 500 lbs.
2. Use 2-1/2-inch by 3/8-inch steel flats for stringers and ¾-inch diameter steel rods for rungs.
3. Rungs to be not less than 16 inches wide (clear distance), space one foot apart, plug welded or shouldered and headed into stringers.
4. Install ladders so that the distance from the rungs to the finished wall surface will not be less than 7 inches.
5. Provide support angles within 12” of top and bottom and not over 48 inches on centers between.

B. Hot dip galvanized after fabrication, per Paragraph 2.03.

2.05 LADDER SAFETY CAGE

A. Equip ladder with safety cage in compliance with Section 29 CFR 1910.27 except as follows.

B. Fabricate from 2 inches wide by ¼-inch thick steel vertical strips and horizontal loops welded to form cage around ladder.

1. Bottom loop radius: 17-1/2 inches.
2. Radius of other loops: 13-1/2 inches.
3. Provide 7 vertical strips equally spaced around perimeter of cage.
4. Space horizontal loops at 48 inches maximum.

C. Minimum clearance from ladder to back of cage: 27 inches.

D. Start cage 7 feet above floor.

E. Extend safety cage 42 inches minimum above top rung and attached to side rails as detailed on Drawings.

F. Provide safety chain at safety cage opening on mezzanine.

G. Hot-Dip galvanize safety cage after fabrication, per Paragraph 2.03.

2.06 PIPE BOLLARDS

A. Eight-inch diameter ASTM A53, Type E or S Grade B.

B. Hot dip galvanize, per Paragraph 2.03, after fabrication.

C. The hollow cores of the pipe shall be filled with concrete and the concrete finished in a dome shaped cap.

D. Field paint “Safety Yellow” in accordance with Section 09 96 00.

PART 3 : EXECUTION

3.01 PREPARATION

A. Provide items to be built into other construction in time to allow their installation:

1. If such items are not provided in time for installation, cut in and install.

B. Prior to installation, inspect and verify condition of substrate.

C. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation:

3.02 INSTALLATION

A. GENERAL: Install work in strict accordance with Drawings and manufacturer's installation instructions. Perform cutting, drilling and fitting required. Accurately set, place and 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 Unibraze. 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 or masonry shall have contact surfaces coated to prevent corrosion. Aluminum items in contact with carbon steel or galvanized steel or stainless steel shall be electrically isolated with gaskets and fastener sleeves.

E. FIELD MEASUREMENTS

1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
2. Contractor responsible for the accurate fit of the work.
3. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection:
    a. Use surveyor's level.
    b. Notify Engineer of any errors or deviations found by such checking.

4. Erect plumb and level; introduce temporary bracing required to support erection loads.
5. Use light drifting necessary to draw holes together:
    a. Drifting to match unfair holes is not allowed.

F. WELDING

1. Conform to AWS D1.1.
2. When joining two (2) sections of steel of different ASTM designations, welding techniques shall be in accordance with a qualified AWS D1.1 procedure.
3. Shore existing members when unbolting of common connections is required.
4. Grind welds smooth where field welding is required.
5. Clean stored material of all foreign matter accumulated during erection period.

G. BOLT FIELD CONNECTIONS

1. Where practicable, conceal fastenings.
2. Use new bolts for re-bolting connections.
3. Unless noted or specified otherwise:
    a. Connect steel members to steel members with 3/4 inch DIA ASTM F3125 Grade 325 high strength bolts.
    b. Provide washers for all bolted connections.
    c. Where exposed, bolts shall extend a maximum of 3/4 inches and a minimum of 1/2 inches above the top nut.
    d. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.
4. Install and tighten ASTM F3125 Grade 325 high-strength bolts in accordance with the RSCC Specification for Structural Joints Using ASTM A325 or A490 bolts.
5. Provide hardened washers for all ASTM F3125 Grade 325 bolts:
    a. Provide the hardened washer under the element (nut or bolt head) turned in tightening.
    b. Provide bearing type connection.
6. After bolts are tightened, upset threads of ASTM A307 unfinished bolts or anchor bolts to prevent nuts from backing off.
7. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing.
8. Provide full penetration welded splices where continuity is required.

H. Provide each fabricated item complete with attachment devices as indicated or required to install.

I. Anchor such that work will not be distorted nor fasteners overstressed from expansion and contraction:

1. Fill space between bearing surface and bottom of base plate with non-shrink grout:

a. Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.

2. Do not remove wedges or shims:

a. Where they protrude, cut off flush with edge of base plate.

3. Fill sleeves around anchor bolts solid with non-shrink grout.

J. Tie anchor bolts in position to embedded reinforcing steel using wire:

1. Tack welding prohibited:

a. Coat bolt threads and nuts with heavy coat of clean grease.

2. Anchor bolt location tolerance:

a. 1/16 inches.

b. Provide steel templates for all column anchor bolts.

K. Install bollards in concrete as detailed:

1. 48 inches projection above ground.

2. 48 inches embedment in concrete, unless detailed otherwise on Drawings.

3. Fill pipe with concrete and round off at top.

L. Repair damaged galvanized surfaces in accordance with ASTM A780:

1. Prepare damaged surfaces by abrasive blasting or power sanding.

2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

M. Anchor ladder to concrete structure with minimum ¾-inch stainless steel anchor bolts with minimum 6 inches embedment.

3.03 CLEANING

A. After erection, installation, or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.

B. Provide surface acceptable to receive field applied paint coatings specified in Specification Section 09 91 13 – Building Exterior Painting or Section 09 91 23 – Building Interior Painting.

END OF SECTION

SECTION 05 50 16
FALL PREVENTION SYSTEM

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This section covers installation of fall prevention systems. Provide one complete fall prevention system for each pump station. Provide sleeves for mast as indicated on the Drawings.

1.02 STANDARDS AND CODES

A. ANSI A10.4 - Safety Requirements for Personnel Hoists on Construction and Demolition Sites

B. Occupational Safety and Health Administration (OSHA)

C. Washington State Department of Labor and Industries, Division of Industrial Safety and health – General Safety and Health Standards (Chapter 296-24-WAC), including all revisions and amendments thereto.

D. U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR Chapter XVII Part 1910 – Occupational Safety and Health standards, including all revisions and amendments thereto.

1.03 SUBMITTALS

A. In accordance with the requirements of the WSDOT Division 1 Special Provisions, submit the following Project Data:

1. Catalog data for all components

PART 2 : PRODUCTS

2.01 GENERAL

Provide two complete Fall Protection Systems by 3M DBI-SALA, no exceptions. Paragraphs 2.02 and 2.03 indicated the major components of the fall prevention system. Additional components shall be provided as required to provide a complete and functional fall prevention system.

2.02 MAST

A. Mast sleeve shall be designed to be cast in place in concrete. The winch mast sleeve shall be constructed of Type 304 stainless steel structural shapes. The removable mast shall consist of a center post and an offset mast assembly. The assembly shall be fabricated from aluminum tubing with a cast aluminum elbow. The mast sleeve and mast shall be manufactured by 3M DBI-SALA. The mast assembly shall be composed of 3M DBI-SALA's adjustable offset davit (Product Number 8518001) and lower mast extension (Product Number 8518003). The floor mounting sleeve shall be Product Number 8512828 (SST) with a heavy-duty sleeve cap (Product Number 8510827). No exceptions.

B. The Davit kit shall be suitable for combined space retrieval, single user 350 lbf, or for fall arrest anchorage for one person per OSHA 1929 Subpart M and ANSI A10.4.

2.03 HOIST

The hoist shall be a self-retracting type designed specifically for confined space entry and retrieval. The hoist shall have a 50-foot long stainless-steel rope. The hoist shall be constructed of stainless steel and aluminum components. The hoist shall be 3M DBI-SALA's Product Number 3400926 (420-lb capacity). No exceptions.

PART 3 : EXECUTION

3.01 GENERAL

Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

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

B. Related Specification sections include but are not necessarily limited to:

1. Section 06 18 00 – Glue-Laminated Construction.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 06 – Wood, Plastics and Composites of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

1. ASTM STANDARDS

a.	A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
b.	A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
c.	A563	Standard Specification for Carbon and Alloy Steel Nuts
d.	F844	Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
e.	F1667	Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

2. INTERNATIONAL CODE COUNCIL STANDARDS

a.	IBC 2018	International Building Code 2018 Edition
b.	ICC ESR-1539	Power Driven Staples and Nails

3. U.S. DEPARTMENT OF COMMERCE STANDARDS

a.	PS 20-15	American Softwood Lumber Standard
b.	PS 1-09	Structural Plywood

4. AMERICAN WOOD COUNCIL STANDARDS

a.	WFCM-15	Wood Frame Construction Manual

5. AMERICAN WOOD PROTECTION ASSOCIATION STANDARDS

   a. AWPA U1 Use Category System: User Specification for Treated Wood

6. AMERICAN NATIONAL STANDARDS INSTITUTE STANDARDS

   a. ANSI/ASME B18.6.1 Wood Screws

   b. ANSI/ASME B18.2.1 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

1.03 SUBMITTALS

A. In accordance with the requirements of the WSDOT Division1 Special Provisions, submit the following Project Data:

1. Provide catalog data and documentation that all lumber and composite lumber materials conform to the appropriate standards and these specifications.

PART 2 : PRODUCTS

2.01 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 preservative treated in accordance with the AWPA Standard U1 Use Category U4A.

1. Gutter and flashing.
2. Vapor barriers and waterproofing.
3. Masonry and/or concrete.

2.02 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.

C. Ceiling plywood must be at least ½" thick but does not need to be fire rated.*

2.03 BOLTS, NAILS, LAG SCREWS, ETC.

At interior plywood wall backing, provide United States Gypsum, Type S-12 screws, bulge head, pilot point, 115/16-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.

2.04 MOISTURE CONTENT

Not to exceed 19 percent for dimensional lumber and 18 percent for plywood, unless more restrictive requirements are specifically noted.

2.05 SAWN STRUCTURAL PLATES

Douglas Fir No. 2 and better or as shown on drawings.

2.06 FASTENERS

A. Where rough carpentry is exposed to weather, in ground contact, or in area of relative high humidity, provide fasteners of AISI Type 304 stainless steel.

B. Where fasteners are in contact with treated wood use hot dip galvanized fasteners or stainless steel fasteners.

C. NAILS, WIRE, BRADS AND STAPLES: ASTM F1667.

D. POWER-DRIVEN STAPES AND NAILS: ESR-1539.

E. WOOD SCREWS: ANSI B18.6.1.

F. LAG BOLTS: ANSI B18.2.1.

G. BOLTS: ASTM A 307, Grade A;

H. NUTS; ASTM A563.

I. WASHERS; ASTM F844.

J. STEEL CONNECTORS: Steel straps, ties, anchors, hangers and hold-downs shall be Simpson Strong-Tie hot dip galvanized ZMAX (ASTM A653 G185) or approved equal.

PART 3 : EXECUTION

3.01 GENERAL

A. Verify all dimensions and conditions before proceeding.

B. Provide erection bracing as necessary until permanent support and stiffening are installed.

C. Carefully lay out, cut, fit, and install rough carpentry items.

1. Use sufficient nails, spikes, screws, and bolts to ensure rigidity and permanence.
2. Drive nails perpendicular to grain of wood in lieu of toe-nailing, where feasible.
3. Provide for installation and support of plumbing, heating and ventilating work.
4. Install work to true lines, plumb and level, unless indicated otherwise.
5. Use metal plugs or inserts for attaching to masonry or concrete.

3.02 WOOD FRAMING

A. Install wood framing in accordance with the AFPA WFCM-15.

B. All stud framing shall be spaced 16 inches O.C., unless noted otherwise.

3.03 PLYWOOD AND APA RATED PANELS

Install plywood and APA Rated Panels in accordance with IBC 2018 Chapter 23.

3.04 SAWN STRUCTURAL PLATES

A. Nominal 2-inch-thick, full width of framing member unless otherwise noted.

B. Unless indicated otherwise on the plans, anchor with ½-inch-diameter expansion bolts at 4-foot centers and 1 foot from each piece; end on single plates at concrete.

C. Stagger ends on double plates.

3.05 WOOD PRESERVATIVE

A. All wood in continuous contact with concrete or masonry shall be pressure treated.

B. Apply liberal brush coat of same material to surfaces cut in the field or bolt holes drilled in field.

3.06 MINIMUM FASTENERS

Unless otherwise detailed on the Contract Drawings, provide not less than the minimum nailing or bolting specified in IBC 2018 Table 2304.10.1

END OF SECTION

SECTION 06 17 00
PREFABRICATED WOOD TRUSSES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies the following:

1. Design, manufacture, and installation of prefabricated wood trusses.

1.02 STANDARDS AND CODES

A. All truss 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. IBC 2018 2018 International Building Code.

1.03 SUBMITTALS

A. In accordance with the requirements of the WSDOT Division1 Special Provisions, submit the following project data:

B. Submit fabricator's technical data covering lumber, metal plates, hardware, fabrication process, treatment (if any), handling and erection.

C. Truss manufacturer shall furnish truss design drawings and a truss placement diagram.

D. The Truss Design Drawings shall include, at a minimum, the information specified below (per the Standard):

1. Building Code used for Design, unless specified on Cover/Truss Index Sheet.
2. Slope or depth, span and spacing.
3. Location of all joints and support locations.
4. Number of plies if greater than one.
5. Required bearing widths.
6. Design loads as applicable, including:
    a. Top Chord live load (for roof Trusses, this shall be the controlling case of live load or snow load);
    b. Top chord dead load;
    c. Bottom chord live load;
    d. Bottom chord dead load;
    e. Additional loads and locations;

f. Environmental Load Design Criteria (wind speed, snow, seismic, and all applicable factors as required to calculate the Truss loads); and

g. Other lateral loads, including drag strut loads.

7. Adjustments to Wood Member and Metal Connector Plate design values for conditions of use.

8. Maximum reaction force and direction, including maximum uplift reaction forces where applicable.

9. Metal Connector Plate type, manufacturer, size, and thickness or gauge, and the dimensioned location of each Metal Connector Plate except where symmetrically located relative to the joint interface.

10. Size, species and grade for each Wood Member.

11. Truss-to-Truss connection and Truss field assembly requirements.

12. Calculated span to deflection ratio and/or maximum vertical and horizontal deflection for live and total load and KCR (creep factor) as applicable.

13. Maximum axial tension and compression forces in the Truss members.

14. Fabrication tolerance per the Standard.

15. Required Permanent Individual Truss Member Restraint location and the method of Restraint/Bracing to be used per the Standard.

1.04 QUALITY ASSURANCE

A. Comply with applicable requirements and recommendations of the following:

1. Truss Plate Institute (TPI) publications:

2. Design Specification for Metal Plate Connected Wood Trusses

3. Commentary and Recommendations for Handling and Erecting Wood Trusses

4. Commentary and Recommendations for Bracing Wood Trusses

5. Quality Control Manual

B. Comply with applicable requirements of "National Design Specification for Wood Construction" published by N.F.P.A.

C. Comply with PS 20 and with applicable rules of the respective grading inspecting agencies for species and grade of lumber indicated.

D. Provide truss connector plates manufactured by a firm which is a member of TPI and which complies with TPI quality control procedures for manufacture of connector plates published in TPI "Quality Control Manual".

E. Provide trusses by a firm which has a record of successfully fabricating trusses similar to type indicated and which practices a quality control program which complies with, or is comparable to the TPI "Quality Control Manual" and which involves an independent inspection and testing agency acceptable to the Architect.

F. Provide metal connector plates from a single manufacturer.

1.05 WARRANTY

Trusses shall be warranted to be free from defects in workmanship, design and materials for a period of 5 years.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Trusses shall be handled during manufacturing, delivery and by the Contractor at the job site so as not to be subjected to excessive bending.

B. Trusses shall be unloaded in a manner so as to minimize lateral strain. Trusses shall be protected from damage that might result from on-site activities and environmental conditions. Trusses shall be handled in such a way so as to prevent toppling when banding is removed.

C. Contractor shall be responsible for the handling, installation, and temporary restraint/ bracing of the Trusses in a good workmanlike manner and in accordance with the recommendations set forth in the latest edition of BCSI.

1. Apparent damage to Trusses, if any, shall be reported to Truss Manufacturer prior to erection.

1.07 DESIGN

A. Trusses shall be designed in accordance with the National Design Standard for Metal Plate Connected Wood Truss Construction (ANSI/TPI 1).

1. Where any applicable design feature is not specifically covered therein, design shall be in accordance with the applicable provisions of the latest edition of the American Forest & Paper Association's (AF&PA's) National Design Specification (NDS) for Wood Construction.

2. Trusses shall be designed for appropriate loading as specified in the Structural General Notes.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the requirements of the Contract Documents, products from the following manufacturers may be incorporated in the Work of this Section:

1. The TRUSS Company, 2802 142nd Avenue East, Sumner, WA, www.thetrussco.com

2. Or equal.

2.02 MATERIALS

A. LUMBER

1. Lumber used shall be identified by grade mark of a lumber inspection bureau or agency approved by the American Lumber Standards Committee, and shall be the size, species, and grade as shown on the Truss Design Drawings, or equivalent as approved by the Truss Design Engineer/ Truss Designer.
2. Adjustment of value for duration of load or conditions of use shall be in accordance with NDS.
3. Fire retardant treated lumber, if applicable, shall meet the specifications of the fire retardant chemical manufacturer, the Truss design and the Standard and shall be re-dried after treatment in accordance with the American Wood-Preservers' Association (AWPA) Standard C20 Structural Lumber – Fire Retardant Treatment by Pressure Processes. Allowable values must be adjusted in accordance with NDS. Lumber treater shall supply certificate of compliance.

B. METAL CONNECTOR PLATES

1. Metal connector plates shall be manufactured by a Truss Plate Institute (TPI) member plate manufacturer and shall not be less than 0.036 in. thick (20 gauge) and shall meet or exceed ASTM A653/A653M grade 33, and galvanized coating shall meet or exceed ASTM A924/924M, coating designation G60. Working stresses in steel are to be applied to effectiveness ratios for plates as determined by test and in accordance with the Standard.
2. In highly corrosive environments, special applied coatings or stainless steel may be required.
3. At the request of the Building Designer, a TPI member plate manufacturer shall furnish a certified record that materials comply with steel specifications.

2.03 MANUFACTURING

Trusses shall be manufactured to meet the quality requirements of the National Design Standard for Metal Plate Connected Wood Truss Construction (ANSI/TPI 1) and in accordance with the information provided in the final approved Truss Design Drawings.

PART 3 : EXECUTION

3.01 INSTALLING, RESTRAINING AND BRACING

A. Trusses shall be set and secured level and plumb, and in correct location. Each Truss shall be held in correct alignment until specified permanent restraint and bracing is installed.

B. Cutting and altering of Trusses is not permitted. If any Truss should become broken, damaged, or altered, written concurrence and approval by a Registered Design Professional is required.

C. Concentrated loads shall not be placed on top of Trusses until all specified restraint and bracing has been installed and decking is permanently nailed in place. Specifically avoid stacking full bundles of plywood or other concentrated loads on top of Trusses.

D. Trusses shall be permanently restrained and braced in a manner consistent with good building practices as outlined in BCSI and in accordance with the requirements of the Construction Documents.

1. Trusses shall furthermore be anchored or restrained to prevent out-of-plane movement so as to keep all Truss members from simultaneously buckling together in the same direction. Such permanent lateral restraint shall be accomplished by:

   a. Anchorage to solid end walls;

   b. Permanent diagonal bracing in the plane of the web members; or (c) other suitable means.

2. Materials used in temporary and permanent restraint and bracing shall be furnished by Contractor.

END OF SECTION

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SECTION 06 20 00
FINISH CARPENTRY

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This section includes wall base, Interior and exterior trim, roof fascias, and other miscellaneous wood trim finish work.

1.02 SUBMITTALS

A. Submit seven (7) copies of the following Project Data in accordance with the WSDOT Division 1 Special Provisions:

1. Samples of trim shapes.
2. Casing stock proposed for work in this section.

PART 2 : MATERIALS

2.01 TRIM

A. Trim dimensions 3½" or less to be kiln dried hardwood. At interiors only, greater than 3½" may be medium density fiberboard.

B. Roof fascias and trims in contact with concrete shall be clear cedar.

2.02 MISCELLANEOUS HARDWARE

Provide all items necessary for installation of work specified herein. Use sufficient nails, spikes, screws, and bolts to ensure rigidity.

PART 3 : EXECUTION

3.01 PREPARATION

Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

3.02 INSTALLATION

A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.

B. Install the work plumb, level, true and straight with no distortions.

C. Scribe and cut work to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. STANDING AND RUNNING TRIM: Install with minimum number of joints possible, using full-length pieces (from maximum lengths of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint. Use scarf joints for end-to-end joints. Fill and sand smooth all joints, nail holes and superficial blemishes prior to applying paint system.

E. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nail for exposed nailings, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.

3.03 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Fill and sand smooth wood surfaces and joints to achieve uniform and unblemished surface, prior to painting

C. Protection. Installer of finish carpentry work shall advise the Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END SECTION

SECTION 06 74 13
FIBERGLASS REINFORCED GRATINGS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Furnish, fabricate, and install all fiberglass reinforced plastic (FRP) open and molded grating, with all appurtenances, accessories and incidentals necessary to produce a complete, operable and serviceable installation as shown on the Contract Drawings and as specified herein, and in accordance with the requirements of the Contract Documents.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 06 – Wood, Plastics, and Composites of the Specifications as referenced or modified. In case of conflict between the requirements of this section and that of the listed documents, the requirements of this section shall prevail.

B. The publications are referred to within the text by the designation only.

1. American Society for Testing And Materials (ASTM) Test Methods:

   a. ASTM D635 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

   b. ASTM E84 Surface Burning Characteristics of Building Materials

1.03 CONTRACTOR SUBMITTALS

A. In accordance with the requirements of the WSDOT Division1 Special Provisions, submit the following Project Data:

1. Shop Drawings: Grating layout, material sizes, types, styles, part or catalog numbers, complete details for the fabrication and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.

2. Product Data:

   a. Manufacturers' literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.

   b. Fiberglass specifications

   c. Submit color samples for Owner selection.

d. Statement from an independent testing laboratory certifying the grating meets the fire retardant and flame speed rating specified.

e. When requested, submit sample pieces of each item specified herein for acceptance by the engineer as to quality and color. Sample pieces shall be manufactured by the method as required for this project.

1.04 QUALITY ASSURANCE

A. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years of experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

B. Manufacturer shall offer a 3-year limited warranty on all FRP products against defects in materials and workmanship.

C. Manufacturer shall be certified to the ISO 9001-2000 standard.

D. Manufacturer shall provide proof of certification from at least two other quality assurance programs for its facilities or products (UL, DNV, ABS, USCG, AARR).

1.05 PRODUCT DELIVERY AND STORAGE

A. DELIVERY OF MATERIALS: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

B. STORAGE OF PRODUCTS: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Adhesives, resins, and their catalysts are to be stored in dry indoor storage facilities between 70- and 85-degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 : PRODUCTS

2.01 GENERAL

A. All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements, and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

B. Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.

C. Resin shall be with chemical formulations as necessary to provide the corrosion resistance, strength, and other physical properties as required.

D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes, or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

E. All grating products shall have a tested flame spread rating of 25 or less per ASTM E84 Tunnel Test. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.

F. All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

2.02 MOLDED FRP GRATING

A. MANUFACTURE: Grating shall be of a one-piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a square mesh pattern. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement in the grating panel shall be no more than 3/16" below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 35% to achieve maximum corrosion resistance, and as required to maintain the structural requirements of the Construction Documents.

After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, resin rich or resin starved areas.

Where covered molded grating is specified, the grating fiberglass cover plate shall be attached to the completed panel of grating by chemical means to ensure integral action of the panel and plate. The panel and grating shall be uniformly clamped together to ensure that all contact surface remain in contact throughout the curing process.

B. NON-SLIP SURFACING: Open Grating and Covered Grating shall have a gritted top surface.

C. Grating bar intersections are to be filleted to a minimum radius of 1/16” to eliminate local stress concentrations and the possibility of resin cracking at these locations.

D. FIRE RATING: Grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E84. Certifications shall be dated within the past two years and test data performed only on the resin shall not be acceptable.

E. RESIN SYSTEM: The resin system used in the manufacture of the grating shall be Corvex®, or approved equivalent. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating product corrosion resistance and shall not be accepted.

F. COLOR: As determined by Owner

G. GRATING DEPTH: 1-1/2” minimum, and as noted on the Plans, with a tolerance of plus or minus 1/16".

H. MESH CONFIGURATION OF GRATING: 1-1/2”x1-1/2” minimum, and as shown on the Plans, with a tolerance of plus or minus 1/16” centerline to centerline.

I. FIBERGLASS TOP PLATE THICKNESS: Unless otherwise noted, 1/8” with a tolerance of 1/32”.

J. PANEL DIMENSIONS: Panel dimensions specified on drawings are nominal sizes and actual panel dimensions should include the clearance gaps as shown in the project support details with a tolerance of plus or minus 1/16".

K. Grating load/deflection requirements at the required span shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Unless noted otherwise, Grating Panels shall be designed for a uniform load of 65 psf or concentrated load of 300 lb. Deflection is not to exceed 0.375” or L/D = 180, whichever is less. Where High Loaded Grating is specified, panels shall be designed for a uniform load of 250 psf or concentrated load of 2000 lb. Deflection is not to exceed 0.500” or L/D = 120, whichever is less.

L. SUBSTITUTIONS: Other products of equivalent or greater strength, stiffness, corrosion resistance and overall quality may be submitted with the proper supporting data to the engineer for review.

2.03 GRATING FABRICATION

A. MEASUREMENTS: Grating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work. When field dimensions are not required, contractor shall determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.

B. LAYOUT: Each covered grating section shall be tied down with appropriate anchors or clips. Manufacturer to provide openings and holes where located on the contract drawings. Grating openings that fit around protrusions (pipes, cables, machinery, etc.) shall be field cut or, when shop fabricated, discontinuous at approximately the centerline of opening so each section of grating is readily removable.

C. SEALING: All shop fabricated grating cuts shall be sealed to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.

D. HARDWARE: Type 316 stainless steel hold-down clips shall be provided and spaced at a maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

PART 3 : EXECUTION

3.01 INSTALLATION

Contractor shall install gratings in accordance with manufacturer's assembly drawings. Fasten grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

3.02 INSPECTION

Shop inspection is authorized as required by the Owner and shall be at Owner's expense. The fabricator shall give ample notice to Contractor prior to the beginning of any fabrication work so that inspection may be provided. The grating shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits. The surface shall have a smooth finish (except for grit top surfaces).

END OF SECTION

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SECTION 07 21 00
INSULATION

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Provide building insulation where shown on the drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Specification sections include but are not necessarily limited to:

1. Section 07 26 00 – Vapor Retarders.
2. Section 07 41 00 – Metal Roofing.

1.02 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Manufacturer's product data for each category of insulation.

1.03 QUALITY ASSURANCE

Upon completion of this portion of the work, complete and post a certificate of insulation compliance in accordance with pertinent requirements of governmental agencies having jurisdiction.

PART 2 : PRODUCTS

2.01 MATERIALS

A. INTERIOR FRAME WALLS: OWENS CORNING fiberglass batts, R-19 resistive value.

B. CEILINGS: OWENS CORNING Foil faced, fiberglass batts, R-30 resistive value.

C. CONCRETE FLOORS AND STEMWALLS: 2" Rigid cellular foam, complying with ASTM C 1289; Type I, aluminum foil both faces; Class 1, non-reinforced foam core, R-38 resistance value. See plans for location.

D. HOT AND COLD WATER PIPING: 1" thick medium density urethane foam, R-7 equivalent. Seal all joints.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions for particular conditions of installation in each case.

B. Fit ends of batts tight.

C. Extend insulation full thickness as shown over entire area to be insulated.

D. Cut and fit tightly around obstructions and fill voids with insulation.

END OF SECTION

SECTION 07 26 00
VAPOR RETARDERS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Under-slab vapor retarder at slab-on-grade.

B. Related Specification sections include but are not necessarily limited to:

1. Section 07 21 00 – Insulation.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 07 – Thermal and Moisture Protection of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

B. American Concrete Institute (ACI):

1. ACI 302.1R Guide to Concrete Floor and Slab Construction.

C. ASTM International (ASTM):

1. ASTM C171 Standard Specification for Sheet Material for Curing Concrete.
2. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
3. ASTM E1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
4. ASTM E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Manufacturer’s installation instructions for placement, seaming and pipe boot installation.

PART 2 : PRODUCTS

2.01 UNDER-SLAB VAPOR RETARDER

A. Extremely low permeance vapor retarders for critically sensitive, low permeance floor coverings. Includes floor coverings of rubber, vinyl, urethane, epoxy and methyl methacrylate, linoleum, and wood.

B. Approved Products and Manufacturers:

1. Stego Wrap 15-mil by STEGO INDUSTRIES LLC.
2. Moistop Ultra by Fortifiber Corp.
3. Vaporblock 15 by Raven Industries, Engineered Films Div.

2.02 ACCESSORIES FOR UNDER-SLAB VAPOR RETARDER

A. SEAM TAPE: High Density Polyethylene tape with pressure sensitive adhesive. Minimum width 4 inches.

B. PIPE BOOTS: Construct pipe boots from vapor retarder material and pressure sensitive tape per manufacturer's printed instructions.

PART 3 : EXECUTION

3.01 PREPARATION

A. Ensure that subsoil is approve by Engineer.

1. Level and tamp or roll aggregate base capillary break to compaction requirements.

3.02 INSTALLATION

A. Under-Slab Vapor Retarder:

1. Install in accordance with manufacturer's printed instructions and ASTM E1643.
2. Unroll vapor retarder with long dimension parallel with direction of the pour.
3. Lap vapor retarder over footings and seal to foundation walls.
4. Overlap joints 6 inches and seal with manufacturer's tape and return up perimeter foundation walls not less than 4 inches.
5. Seal all penetrations (including pipes) with manufacturer's pipe boot.
6. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
7. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches, and sealing all four sides with tape.

3.03 ADJUSTMENT

Repair damaged sections of under-slab vapor retarder with same material and seal with seam tape as required.

END OF SECTION

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SECTION 07 41 00
METAL ROOFING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. The work includes, but is not necessarily limited to, furnishing and installation of all preformed metal roofing, compatible gutters and downspouts from metal roofing manufacturer, and accessories as indicated on the drawings and specified herein.

B. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips inside laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

C. Related Specification sections include but are not necessarily limited to:

1. Section 05 50 00 – Metal Fabrications.
2. Section 06 10 00 – Rough Carpentry.
3. Section 07 62 00 – Flashing and Sheet Metal.
4. Section 07 92 00 – Caulking and Sealants.
5. Section 09 91 13 – Building Exterior Painting.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 07 – Thermal and Moisture Protection of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail:

B. TESTING AND CERTIFICATION

1. Wind Uplift: UL 580 test, Class 90 rated per Construction #364 minimum 22-gauge panels when installed over 5/8” plywood, with roof panel fastener clips spaced 2’-0” on center maximum.
2. Air Infiltration: Panel to meet the following standard when in accordance with ASTM E1680.
    a. With factory-applied continuous sealant 0.08 cfm/lineal ft. of panel seam at 1.57 psf positive pressure, and 0.13 cfm/lineal ft. of panel seam at 1.57 psf negative pressure.

C. Water Penetration: Panel to meet the following standard when tested in accordance with ASTM E1646:

1. With factory-applied continuous sealant, no leakage at 6.24 psf.

1.03 SUBMITTALS

A. PRODUCT DATA

1. Submit manufacturer's technical product data, installation instructions and recommendations for each type of roofing required. Include data substantiating that materials comply with requirements.

B. SAMPLES

1. Prior to ordering products, submit manufacturer's standard color samples for Owner's selection.
2. Prior to starting work, submit (3) 12" long panel samples showing shape and a representative color chip for Owner's acceptance.

C. SHOP DRAWINGS

1. Submit complete shop drawings detailing all perimeter flashings and joints in accordance with the manufacturer's standard recommendations.
2. Describe all proposed details that deviate from what is shown on the plans.
3. Details must allow for expansion and contraction.

D. DESIGN CRITERIA

1. Wind Uplift: The roof system manufacturer shall provide an attachment schedule or supporting calculations to resist the following uplift loads:
   a. Uplift loads as calculated using the 2018 Edition of the IBC with an 115 MPH basic wind speed, Exposure Factor C, and importance Factor 1.15.
2. Drag Loading: The roof panel manufacturer shall provide attachment schedule calculations to resist drag loads induced by a snow load of 25 psf.

1.04 QUALITY ASSURANCE

A. INSTALLER'S QUALIFICATIONS

1. Installer must be approved by the Panel Manufacturer in writing prior to work commencing.
2. Installer shall meet the following:
   a. Successfully applied five metal roofs of comparable size and complexity which reflects a quality weather-tight installation.
   b. Have been in business for a minimum period of five years in the region where the work will be performed.

B. MANUFACTURER'S QUALIFICATIONS

1. Manufacturer shall have a minimum of 10-years of experience supplying metal roofing to the region where the work is to be done.
2. Comply with current independent testing and certification as specified.
3. Manufacturer shall provide proof of $2,000,000 liability insurance for their metal roof system and comply with current independent testing and certification as specified.
4. The roof panel manufacturer must also subscribe to Underwriter's Laboratories' "Follow Up Service" assuring continuing product compliance with UL requirements. Shipment packaging of panels and attachment clips must bear UL classification markings.
5. Panel manufacturers without full supporting literature; Flashings & Details Guides, Guide Specifications and Technical Support, shall not be considered equal to the specified product.

C. REGULATORY AGENCY REQUIREMENTS

1. Comply with IBC and local Building Code requirements if more restrictive than those specified herein.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect against damage and discoloration.

B. Handle panels with non-marring slings.

C. Do not bend panels.

D. Store panels above ground, with one end elevated for drainage.

E. Protect panels against standing water and condensation between adjacent surfaces.

F. If panels become wet, immediately separate sheets, wipe dry with clean cloth, and allow to air dry.

G. Painted panels shall be shipped with protective plastic sheeting or a strippable film coating between all panels. Remove any strippable film coating prior to installation and in any case, do not allow the strippable film coating to remain on the panels in extreme heat, cold, or direct sunlight or other UV source.

1.06 PROJECT CONDITIONS

A. Examine the conditions and substrates in which metal roofing work is to be installed. Substrate shall be installed level, flat and true to avoid panel stresses and distortion.

B. Field measurements shall be taken prior to fabrication of panels.

C. Proceed with roofing installation only after satisfactory conditions are met.

1.07 WARRANTY

A. SPECIAL WARRANTY: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Structural failures including rupturing, cracking, or puncturing.
    b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Two years from date of Substantial Completion.

B. SPECIAL WARRANTY ON PANEL FINISHES: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 10 years from date of Substantial Completion.

C. SPECIAL WEATHER TIGHTNESS WARRANTY: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weather tight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. AEP Span, A Division of ASC Profiles Inc, Tacoma WA (Design Span© hp):

B. Taylor Metal Products, (Versa-Span)

C. ALTERNATES

1. Specifications requirements are based on the AEP Span system as the design standard. Approval of substitute systems is required prior to bid. The Owner will be the sole judge of what qualifies as an “equal” system. To be approved as an equal system, submit or respond to all items in “Quality Assurance”, “Performance Requirements” and “Submittal” sections of this specification. All submittals must be received in the

Owner's office a minimum of ten (10) working days prior to bid.

2.02 MATERIALS

A. PANELS

1. Base Metal:
    a. Material: Steel conforming to:
        1) ASTM A792 minimum yield 50,000 psi, thickness 22 gauge.
    b. Protective Coatings:
        1) Conform to ASTM A792, AZ50 (Zincalume®/Galvalum®). Grade 40, structural quality.
2. Exterior Finish:
    a. DuraTech® 5000 (polyvinylidine Fluoride), full 70% Kynar® 500/Hylar 5000® consisting of a baked-on 0.2 mil corrosion resistant primer and a baked-on 0.8 mil finish coat for a total of 1.0 mil dry film thickness, with a specular gloss of 10-30% when tested in accordance with ASTM D523-89 at 60°.
    b. Zincalume® Plus/Galvalume® Plus protective coating.
    c. DuraTech® mx metallic finish, consisting of a baked-on acrylic primer (0.2 mil) and a baked-on Poluninylidine Fluoride finish coat (0.8 mil) totaling a nominal 1.0 mil dry film thickness, with a specular gloss of 20-35% when tested in accordance with ASTM D523-89 at 60°.
3. Interior Finish:
    a. Primer Coat Material: Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils; finish coat material: polyester paint, finish coat dry film thickness: 0.35 mils.
    b. Total Interior Dry Film Thickness: 0.50 mils.
    c. Color: Off-White.
4. Color:
    a. Manufacturer's standard selection of not less than 22 colors. Owner to choose color from standard color selection.
    b. All accessories colors to be chosen by Owner from standard color selections.
5. Factory-Applied Seam Sealant:
    a. Cold-applied, non-skinning, butyl mastic sealant.
6. Configuration:
    a. Standing Seam: Roof panels shall consist of integral self-locking standing 1-3/4" high spaced 12" on center with striations

2.03 GUTTERS AND DOWNSPOUTS

GUTTERS AND DOWNSPOUTS: 29-gauge min (unless noted otherwise on the drawings) steel matching material grade and coatings as the roofing materials. See Section 07 62 00 – Flashing and Sheet Metal for additional requirements.

2.04 ACCESSORIES

A. Provide components approved by roof panel manufacturer and required for a complete weather tight panel system including trim, copings, fascia, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by Manufacturer.
2. Closures: Provide closures at eaves, rakes, hips and ridges, fabricated of same metal as metal panels.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or pre-molded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
4. Concealed Standard Anchor Clips: Clips must be extruded aluminum, ONE (1) piece clip with projecting legs for additional panel alignment and provision for unlimited thermal movement in each direction along the longitudinal dimension.
5. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
6. Gutter Strips: Provide concealed gutters strips as required to maintain uniform gutter slope.
7. Panel Sealants:
    a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.
    b. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
    c. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.
8. Underlayment Materials:
    a. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

b. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

c. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

B. FABRICATION

1. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

2. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

3. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

4. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

b. End Seams for Other Than Aluminum: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

c. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

e. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

PART 3 : EXECUTION

3.01 EXAMINATION

A. EXISTING CONDITIONS

1. Verify that members to receive panels are complete, accurately sized and located, in true plane, secure and otherwise properly prepared.

2. Prior to starting work, notify General Contractor about any defects requiring correction.
3. Do not start work until conditions are satisfactory.

3.02 PREPARATION

A. FIELD MEASUREMENTS

1. Verify prior to fabrication.
2. If field measurements differ from drawing dimensions, notify Architect/Engineer prior to fabrication.

B. PROTECTION

1. Treat, or isolate with protective material, and contacting surfaces of dissimilar materials to prevent electrolytic corrosion.
2. Require workmen who will be walking of Roofing Panels to wear clean, soft-soled work shoes that will not pick up stones or other abrasive material which could cause damage or discoloration.
3. Protect Work of other Trades against damage and discoloration.

C. SURFACE PREPARATION

1. Clean and dry surfaces prior to applying sealant.

3.03 INSTALLATION

A. PANELS

1. Follow roof panel manufacturer’s directions.
2. Install panel seams vertically.
3. Lap panels away from prevailing wind direction.
4. Do not stretch or compress panel side-lap.
5. Secure panels without warp or deflection.
6. Fully engage interlocking seams.
7. Remove strippable protective film, if used, immediately preceding panel installation.

B. ALLOWABLE ERECTION TOLERANCE

1. Maximum Alignment Variation: 1/4” in 40 feet.

C. FLASHING

1. Follow Manufacturer’s directions and Engineer approved Shop Drawings.
2. Install flashings to allow for thermal movement.
3. Remove strippable protective film, if used, immediately preceding flashing installation.

D. CUTTING AND FITTING

1. Neat, square, and true. Torch cutting is prohibited.
2. Openings 6 inches and larger in any direction: Shop fabricate and reinforce to maintain original load capacity.
3. Debur cut edge where necessary to saw-cut panels.

3.04 CLEAN UP AND CLOSE OUT

A. PANEL DAMAGE AND FINISH SCRATCHES

1. Do not apply touch-up paint to damaged paint areas that involve minor scratches.
2. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Architect's or Owner's representative.

B. CLEANING AND REPAIRING

1. At completion of each day's work and at work completion, sweep Panels, Flashings and Gutters clean. Do not allow fasteners, cuttings, fillings, or scraps to accumulate.
2. Remove debris from Project Site upon work completion or sooner, if directed.

END OF SECTION

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SECTION 07 62 00
FLASHING AND SHEET METAL

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all materials, labor, tools, and services to install flashing, sheet metal items, roofing accessories, and building expansion joint materials for moisture protection as required for a complete weather-tight system.

B. Related Specification sections include but are not necessarily limited to:

1. Section 07 41 00 – Metal Roofing.

1.02 GUARANTEE AND WARRANTIES

A. Guarantee all sheet metal against leakage, physical deterioration, and mechanical failure for a period of 2 years. This is an extension of the normal 1-year guarantee specified elsewhere.

B. Provide manufacturer's 20-year warranty on color-coated materials.

1.03 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Product data - manufacturer's product specifications, installation instructions, and general recommendations for specified sheet material and fabricated products.
2. Samples
   a. Two 8" square samples of specified sheet materials to be exposed as finished surfaces.
   b. Two 12" long samples of prefabricated gutters and downspout with connection to gutter and mounting bracket.

PART 2 : PRODUCTS

2.01 FLASHING AND SHEET METAL

See Section 07 41 00 – Metal Roofing. Ensure compatibility with metal roofing.

2.02 METAL ACCESSORIES

Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required, matching, or compatible with material being installed, non-corrosive and of the size and gauge required for the application.

PART 3 : EXECUTION

3.01 GENERAL

A. Anchor work securely, providing for thermal expansion.

1. Conceal fasteners where possible
2. Install work true to line and level.
3. Install work with laps, joints, and seams which will be permanently watertight and weatherproof.

B. Protect galvanized and non-ferrous metal surfaces from corrosion or galvanic action by an application of a heavy bituminous paint on surfaces which will be in contact with concrete, masonry, or dissimilar metals. Do not allow paint to get onto visible masonry surfaces.

3.02 PROTECTION

A. Protect materials against exposure to weather and corrosion.

B. Exercise care in the handling of flashing and sheet metal to ensure that this work and the work of other trades is not damaged before, during, or after installation.

END OF SECTION

SECTION 07 92 00
CAULKING AND SEALANTS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all materials, labor, tools, and services to apply caulking or sealing of joints around windows, doors, and over frames, and any other spaces noted on the drawings to be caulked or sealed.

B. Related Specification sections include but are not necessarily limited to:

1. Section 07 41 00 – Metal Roofing.
2. Section 08 11 00 – Steel Doors and Frames.
3. Section 23 30 00 – HVAC Air Distribution.

1.02 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Manufacturer's product specifications.
2. Handling/installation/curing instructions and performance tested data sheets for each product required.

PART 2 : PRODUCTS

2.01 SEALANT

GENERAL ELECTRIC silicone sealant or approved equal.

2.02 COLOR OF SEALANT

Approximate color of adjacent surfaces, unless otherwise directed.

2.03 PRIMER

As recommended by the manufacturer of the compound or sealant.

2.04 BACKUP MATERIALS

A. Joints greater than 3/8" shall be partially filled with polyethylene backer tubing prior to sealing.

B. Material shall be non-staining to sealant.

C. Depth of back-up material shall be such as to provide a sealant depth approximately ½ of width.

PART 3 : EXECUTION

3.01 FILLING JOINTS

A. PRELIMINARY

1. Be sure that joints are clean and dry before filling, caulking, and sealing.

B. TUBING

1. Install tubing in joints in accordance with manufacturer's directions. Provide materials in lengths as long as practical. Stretch and force into joint with proper tool to uniform depth.

3.02 PROTECTION

Mask or use other appropriate techniques to protect surfaces adjacent to joint to be sealed or caulked.

3.03 WORKMANSHIP

A. Apply silicone sealant in accordance with manufacturer's directions.

B. Caulk joints before final coat of paint is applied, filling joints and voids solid. Superficial pointing with skin bead is not acceptable. Select appropriate caulking gun nozzle for the joint to be treated. When finished, remove excess compound and sealant leaving surfaces neat, smooth, and clean.

3.04 SCOPE OF WORK

A. At joints of all dissimilar materials

B. At joints called for on construction drawings

END OF SECTION

SECTION 08 11 00
STEEL DOORS AND FRAMES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes:

1. Doors: Seamless, hollow, or composite construction standard steel doors for exterior locations.
2. Frames: Pressed steel frames for doors.

B. Related Sections:

1. Section 04 22 00 – Concrete Unit Masonry.
2. Section 08 71 00 – Door Hardware.
3. Section 09 91 13 – Building Exterior Painting.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1. ASTM International (ASTM)
   a. ASTM A153
   b. ASTM A366
   c. ASTM 568
   d. ASTM A569
2. American National Standards Institute (ANSI)
   a. ANSI A115.1
   b. ANSI A224.1
3. Steel Door Institute
   a. ANSI/SDI-100
   b. SDI 117

1.03 QUALITY ASSURANCE

Provide doors and frames complying with Steel Door Institute “Specifications for Standard Steel Doors and Frames” ANSI/SDI-100 and as herein specified.

1.04 SUBMITTALS

A. In accordance with the requirements of the WSDOT Division 1 Special Provisions, submit the following Project Data:

1. Product data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

2. Shop Drawings showing fabrication and installation of standard steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

   a. Provide schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.

   b. Indicate and coordinate glazing frames and stops with glass and glazing requirements.

3. LABEL CONSTRUCTION CERTIFICATION: Submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Owner; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide ¼-inch spaces between stacked doors to promote air circulation.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. AVAILABLE MANUFACTURERS: Subject to compliance with requirements, manufacturers offering standard steel doors and frames which may be incorporated in the work include; but are not limited to, the following:

1. Ceco Corp

2. SteelCraft Manufacturing Co.

3. Optimum Window Mfg.

4. Or equal.

2.02 MATERIALS

A. HOT-ROLLED STEEL SHEETS AND STRIP: Commercial quality carbon steel, pickled and oiled, complying with ASTM A569 and ASTM A568.

B. COLD-ROLLED STEEL SHEETS: Commercial quality carbon steel, complying with ASTM A366 and ASTM A568.

C. SUPPORTS AND ANCHORS: Fabricate of not less than 18-gage sheet steel.

D. INSERTS, BOLTS, AND FASTENERS: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A153, Class C or D, as applicable.

E. SHOP APPLIED PAINT: Apply after fabrication.

1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

2.03 STANDARD STEEL DOORS

A. Provide flush, seamless steel doors with top edges closed flush, seams continuously welded of SDI grades and models specified below or as indicated on drawings or schedules:

1. Exterior Doors: ANSI/SDI-100, Grade III, extra heavy-duty, Model 4, minimum 16-gage fabricator primed steel faces, U-Value = 0.157 maximum, STC = 32 minimum.

B. INTERNAL STIFFENERS: Formed steel, 22-gauge, vertical stiffeners at 6-in. o.c. maximum, welded to each face of door at 5-in. o.c. intervals.

C. INSULATION: Polystyrene core.

2.04 FRAMES

A. TYPE: Mitered and welded steel frames.

1. Exterior door frames of 14-gauge cold-rolled steel with integral thermal break. Provide standard profiled frames as detailed.

B. ANCHORS

1. At reinforced CMU walls use 3/8-inch round countersunk flat head screws set in lead anchors.
2. Floor: Not lighter than 12-gauge, minimum two fasteners at each jamb.
3. Stops and Trim: Profiles indicated, 18-gauge.

C. GROUT SOLID: All hollow-metal door frames after installation. Coordinate block-outs with electric strikes, conduit chases, etc.

D. PLASTER GUARDS: Provide minimum 26-gauge steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.05 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp, or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with ANSI/SDI-100 requirements.

1. Internal Construction: Manufacturer's standard 22-gauge vertical steel stiffeners, 6 in. apart, welded at not more than 5 in. o.c. with fiberglass insulation.
2. Clearances: Not more than 1/8-in. at jambs and heads.
3. Armor Plate: Armor-plate gap between double-doors full height to discourage prying by vandals.

B. Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold-rolled steel.

C. TOLERANCES: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel.

E. EXPOSED FASTENERS: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

F. HARDWARE PREPARATION: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Series Specifications for door and frame preparation for hardware.

G. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at project site.

H. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames," published by Door and Hardware Institute.

I. SHOP PAINTING: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

2.06 DOOR SCHEDULE

See Door Schedule as shown in the Architectural Drawings.

PART 3 : EXECUTION

3.01 INSTALLATION

A. GENERAL: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. PLACING FRAMES: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames," unless otherwise indicated.

1. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. In masonry and concrete construction, locate 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry Tee anchors.

C. DOOR INSTALLATION: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.

1. See Drawings for acoustic gasketing requirements on exterior man-doors.

3.02 ADJUST AND CLEAN

A. PRIMER TOUCHUP: Immediately after erection, sand smooth any rusted or damaged areas of paint and appropriate touch-up.

B. FINAL ADJUSTMENTS: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION

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SECTION 08 31 00
ACCESS HATCHES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Specification section includes:

1. Access Hatches: H-30 loading.
2. Safety Grating System.
3. Ladder Safety Extension Post.

1.02 STANDARDS AND CODES

A. American Association of State Highway and Transportation Officials (AASHTO).

B. ASTM International (ASTM)

1.	A554	Standard Specification for Welded Stainless Steel Mechanical Tubing.
2.	A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3.	F593	Standard Specification for Stainless Steel Bolts, Hex Caps Screws and Studs.

1.03 QUALITY ASSURANCE

SINGLE SOURCE RESPONSIBILITY: Contractor shall obtain all access hatches and safety grating system from one manufacturer and shall coordinate the design and all associated requirements with the hatch manufacturer and the concrete slab design shown on the Drawings.

1.04 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's technical data and installation instructions.
    c. Schedule, types, locations, finish, latching provisions and other pertinent information.
    d. Manufacturer’s standard warranty on safety grating system.
    e. Manufacturer’s extended guarantee or warranty for access hatches.

f. Access Hatch Gate Stem Access Opening details including location and coordination with Contractor.

2. Operation and Maintenance Manuals.

3. Warranty:

a. Manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee.

b. Special guarantee shall provide for correction, or at option of Owner, removal and replacement of access hatches found defective during a period of five (5) years after date of Substantial Completion.

c. Duties and obligations for correction or removal and replacement of defective Work as specified in Division 1.

4. Certifications for H-30 loading access hatches.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Access Hatches:

a. LW Products.

b. Bilco Company.

c. Or accepted equal.

2. Safety Grating System:

a. Access Hatch manufacturer's standard safety grating system.

3. Ladder Safety Extension Post:

a. Bilco LadderUp.

b. USF Fabrications.

c. Or accepted equal.

2.02 MANUFACTURED UNITS

A. All access doors shall be provided by the same manufacturer when possible.

B. Unless noted otherwise, all access hatches shall be H-30 rated.

C. ACCESS HATCH

1. Frame: Extruded aluminum channel frame with a 1-inch anchor flange around the perimeter.

2. Bituminous coated when in contact with concrete.

3. Cover: 3/8-inch mill finished aluminum diamond plate. Provide stiffeners as needed to meet load requirements.

4. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the covers when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" gusset support plate. No more than 30 pounds of force shall be required to open hatch cover.

5. Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to the covers with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.

6. All hardware:

    a. ASTM F593 Type 316 stainless steel.

    b. Hinges: Stainless steel hinges, each having a minimum 3/8" (9.5mm) diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame.

    c. Covers shall be equipped with a hold open arm that automatically locks the cover in the open position.

    d. Covers shall be fitted with the required number and size of compression spring operators. Springs shall have an electrocoated acrylic finish.

    e. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.

    f. Compression spring tubes shall be an anti-corrosive composite, all fasteners shall be Type 316 stainless steel material.

7. Grip handle: Vinyl.

8. Fabricate frame with anchor flange around perimeter and 1-1/2 inch diameter drainage coupling. Locate drainage coupling in location shown on the Drawings.

9. Reinforced to accommodate specified loading.

10. Fabricate doors to open 90 degrees with assistance of spring operators and automatically lock into open position.

11. Furnish with slam lock and removable key handle. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the covers and the latch release shall be protected by a flush, gasketed, removable screw plug.

12. Furnish with recessed padlock hasp and padlock. Hold down anchorage for the access doors shall be limited to access hatches larger than 3'-0" x 3'-6"-FT.

13. Furnish with secondary fall through safety grating system and/or ladder safety extension posts where specified in the Access Hatch Schedule.
14. Size(s): Sizes shall be as specified in the Access Hatch Schedule and as shown on the Drawings.
15. Hinge Direction: as shown on the Drawings.
16. EPDM gasket.

D. ACCESS HATCH GATE STEM ACCESS OPENING

1. Provide hinged opening with slam lock and removable key handle.
2. Opening shall be designed by hatch manufacturer and reinforced to maintain same load rating as the hatch.
3. Opening shall be located within the leaf of the hatch.
4. Clear opening size as indicated on the Drawings.
5. Coordinate exact location with Contractor to center opening over gate stem.
6. Materials of construction shall match materials for Access Hatch.
7. Provide at locations as specified in the Access Hatch Schedule.

E. SAFETY GRATING SYSTEM

1. Platform:
   a. Aluminum safety grating with H-30 load rating.
   b. Finish:
      1) Powder coated.
      2) Color: Safety orange or safety yellow.
2. Hardware:
   a. ASTM F593 Type 316 stainless steel.
   b. Tamper proof ASTM F593 Type 316 stainless steel.
3. Provide automatic lock to keep gratings in the open position.
4. Size: size grating platform to allow 6 inches clear space on each unhinged side for visual observation.
5. Provide padlock hasp for Owner provided padlock.
6. Safety grating shall hinge same side as access hatches.
7. Secondary fall through safety grating system shall be installed at the factory per the manufacturer.
8. Provide at locations as specified in the Access Hatch Schedule.

2.03 ACCESSORIES

A. LOAD RATING PLATES

1. Minimum 18 GA Type 316 stainless steel, ASTM A666.
2. Engraved with maximum design live load allowed for unit on which it will be mounted.
3. Load shall be displayed in English units as well as metric units.
4. Size as required for text as needed.
5. Text:
    a. Font: Helvetica Narrow, all caps.
    b. Size: 1/4-inch height.
    c. Depth of engraving: 3 mils.
6. Finish:
    a. Text:
        1) Black epoxy baked on paint.
        2) Plate to have finish conductive to paint application.
    b. Entire plate shall be coated with baked on clear coat on front and back side.
7. Attach to top of all access hatches using ASTM F593 Type 316 stainless steel screws in location determined by manufacturer:
    a. Provide a neoprene gasket under the plate to separate the stainless steel from the aluminum cover or frame.

B. LADDER SAFETY EXTENSION POST

1. Telescoping tubular mill finish aluminum section that automatically locks into place when fully extended.
2. Stainless steel spring and hardware.
3. Factory assembled with all hardware necessary for mounting to ladder.
4. Posts to have adjustable mounting brackets to fit ladder rung spacing and clamp brackets to accommodate ladder rungs up to 1-3/4” in diameter.
5. Balancing spring balances mechanism to provide smooth, easy, controlled operation when raising and lowering the post.
6. Provide at locations as specified in the Access Hatch Schedule.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Hatch design and construction requirements shall be coordinated with the concrete slab design shown on the Drawings. Access hatch shall be cast into the concrete slab shown on the Drawings.

C. Hatches and safety grating shall be coordinated with access ladder locations and requirements for entry as shown on the Drawings.

3.02 ACCESS HATCH SCHEDULE

Location	Size/# of Leafs	Ladder Safety Extension Post	Safety Grating System*	Gate Stem Access Opening**
PS-19 Wet Well	36” x 54” Single Leaf	N/A	Yes	No
PS 19 Wet Well	18” x 24” Single Leaf	N/A	N/A	N/A
PS 19 Wet Well	36” x 36” Single Leaf	N/A	Yes	N/A
PS19 Fuel Monitoring Vault	24” x 24”	N/A	N/A	N/A
PS 31 Wet Well	60” x 84 Double Leaf	N/A	Yes	N/A
PS-31 Valve Vault	60” x 72” Double Leaf	Yes	No	Yes
* Coordinate with pump manufacturer so clear opening is adequate to remove pumps. ** Coordinate exact location with Contractor				

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Provide door hardware in accordance with the Contract Documents.

B. Related Specification sections include but are not necessarily limited to:

1. Section 08 11 00 – Steel Doors and Frames.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 03 – Concrete of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1. Builders Hardware Manufacturers Association (BHMA):
   a. ANSI / BHMA 156.18, Standard for Materials and Finishes.
2. International Code Council (ICC):
   a. International Building Code (IBC 2015), as amended by State in which Project is located.
3. National Fire Protection Association (NFPA):
   a. NFPA 80, Standard for Fire Doors and Other Opening Protectives.

1.03 QUALITY ASSURANCE

A. SUPPLIER: A recognized architectural finish hardware supplier, with warehousing facilities, and who is, or who employs an experienced architectural consultant who is available, at reasonable times during the course of the Work, for consultation about Project's hardware requirements, to Owner, Engineer, and Contractor.

B. Hardware shall be suitable and adapted for its required use and shall fit its designated location. The scheduled hardware indicates design intent and level of quality. Should any hardware as shown, specified, or required fail to meet the intended requirements or require substitution to suit or fit the designated location, determine the correction or modification on Hardware Submittal.

1. Verify and provide appropriate strikes for locks and latches specified.
2. Provide dustproof strikes for flush bolts and dead bolts.

C. CODES AND STANDARDS: Unless otherwise noted, comply with the following:

1. International Building Code (IBC 2015).

2. Review hardware for compliance with IBC Chapter 10.

D. Provide engineering and / or design services for electrified door hardware such as wiring diagrams and coordination of components and interfacing of power and fire alarm systems. Power supplies are scheduled for all electric hardware but may serve more than a single opening. Review operation of doors and provide interfaces on power supplies as required. Provide accessories and cable as required for complete operation.

E. WARRANTIES: Furnish manufacturer's standard 10-year warranty for all closers.

1.04 SUBMITTALS

A. PRODUCT DATA: Submit manufacturer's technical product data for each item of hardware. Include whatever information may be necessary to show compliance with requirements and include instructions for installation.

B. HARDWARE SCHEDULE: Submit Final Hardware Schedule identifying each door or opening by the number used in the Contract Documents. Coordinate hardware with doors, frames, and related Work to ensure proper size, thickness, hand, function, and finish of hardware.

1. Final Hardware Schedule Content: Prepare Schedule indicating complete designations of every item required for each door or opening. Include the following information:

a. Type, style, function, size, and finish of each hardware item.

b. Name and manufacturer of each item.

c. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.

d. Mounting locations for hardware.

e. Door and frame sizes and materials.

f. Wiring diagrams for controlled access doors.

C. TEMPLATES: Furnish hardware templates to each fabricator of doors, frames, and other work to be factory-prepared for the installation of hardware. Upon request, check Shop Drawings of such other Work, to confirm that adequate provisions are made for proper location and installation of hardware.

D. SPECIAL TOOLS: Provide to the Owner two sets of any special tools shipped with the door hardware products required for maintenance and installation. Deliver to Contracting Officer at completion of Work.

E. OPERATIONS AND MAINTENANCE DATA: Submit maintenance manuals, which shall include as-built Hardware Schedule, catalog cuts, template lists with templates and warranty information. One additional copy shall either be delivered with the permanent keys or given separately to the Owner at Substantial Completion. This copy shall contain parts data for exit devices, locksets and closers and catalog cuts of all electrical products, to include manufacturer's name.

F. KEYING SCHEDULE: After receipt of the approved Door Hardware Schedule, the hardware supplier shall meet with the Owner to determine the keying requirements for the Project. This request shall be made through the Contractor. At this meeting, the keying system shall be discussed, and all lockset functions reviewed to insure they are functionally correct. At the same meeting, the electrical operations and conditions affecting the access controls and other electronic operators and controls shall be reviewed and confirmed. Four complete copies of the keying schedule and explanations of the operation of the electronic hardware shall be submitted to the Contractor for distribution to the appropriate parties. This document shall contain riser diagrams and point-to-point wiring diagrams to facilitate the correct installation of the material.

1.05 PRODUCT HANDLING

A. Tag each item or package separately, with identification related to Final Hardware Schedule, and include basic installation instructions with each item or package. Save installation instructions for complex hardware such as closers and turn over to Owner.

B. Deliver individually packaged hardware items at the proper times to the proper locations (shop or Project Site) for installation.

C. Provide secure lock-up for hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the Work will not be delayed by hardware losses, both before and after installation.

PART 2 : PRODUCTS

2.01 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware is indicated in Door Hardware Schedule at end of this Section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's product designations: One or more manufacturers are listed for each hardware type required. Provide either the product schedule, or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers which comply with requirements including those specified elsewhere in this Section.
2. Alternate manufacturers: Where more than one acceptable manufacturer is listed, the listing does not approve all products of the alternate manufacturers. Review the details and Project requirements, especially projections and setbacks, to determine that the alternate product conforms to the Project design.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to requirements, provide products by one of the following manufacturers for each type of hardware:

1. Locks and Latches: KABA Simplex. No Substitutions.
2. Cylinders and Keying: Same manufacturer for locksets.
3. Hinges: Bommer Industries, Hager.
4. Surface Mounted Closers: Von Duprin. No Substitutions.
5. Door Acoustical Gaskets: Pemko.
6. Exit Devices: Von Duprin. No Substitutions.
7. Threshold: Pemko
8. Self-Contained (Stand-Alone) Keypad and Card Reader Locks and Exit Device Trim: Locknetics, Best Access Systems, OSI Security Devices.

2.03 MATERIALS AND FABRICATION

A. HAND OF DOOR. Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement and shown.

B. FINISH: Finish of locksets, butts, bolts, door stops and exit devices shall be 626 per ANSI / BHMA 156.18. Closers shall be manufacturer's standards silver colored finish (SBL) unless otherwise noted.

C. FASTENERS: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

D. Furnish Philips flat-head screws for installation with each hardware item unless otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other Work, to match finish of such other Work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.

E. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of the type specified are available with concealed fasteners. Do not use thru-bolts for installation of closers, magnetic holders and exit devices.

2.04 BUTTS

A. TYPE: ANSI/BHMA A156.1, Stainless steel, full-mortise, anti-friction bearing, Grade 1.

B. SIZE: 4-1/2 x 4-1/2 inches.

C. QUANTITY: Three (3) each up to and including 90 inches in height. Add one additional hinge for every additional 30 inches or fraction thereof.

D. Exterior out swinging doors shall have non-removable pin feature.

1. Set screw in barrel.

2. Pin non-removable when door is closed.

3. Type BB410A, N.R.P.

   a. Acceptable substitutions: Stanley, Hagar.

2.05 LOCK CYLINDER AND KEYING

A. EXISTING SYSTEM: Grandmaster key the locks to the Owner's existing Yale system.

B. RE-CORE CYLINDERS: Equip locks with 6-pin removable core cylinders with Yale keyway as determined by Owner. Provide construction master key system which permits voiding of construction keys without cylinder removal.

C. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change keys for each lock which is not designated to be keyed alike with a group of related locks.

1. Permanently inscribe each key with number or lock that identifies cylinder manufacturer key symbol, and notation "DO NOT DUPLICATE".

2. Key material: Provide keys of nickel silver only.

3. Key quantity: Furnish keys in quantities as follows:

   a. 3 each Grand Master keys.

   b. 6 each Master keys.

   c. 3 each control keys.

   d. 3 each change keys per keyed alike group.

2.06 LOCKS, LATCHES AND BOLTS

A. DESIGN: KABA Simplex L1000 Series Mechanical Push Button Lock.

B. STRIKES: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.

C. LOCK THROW: Comply with UL requirements for throw of bolts and latch bolts on fire-rated openings.

D. BEVELS: Except as otherwise in Door Schedule remarks, provide lock fronts with 93-degree bevels and coordinate any variances with Door Shop Drawings.

E. BOLTS: 6-inch flush bolt, stainless steel.

2.07 CLOSERS AND DOOR CONTROL DEVICES

A. SIZE OF UNITS: Except for fire exit doors, comply with State barrier-free requirements for size of door control unit, depending upon size of door, and frequency of use.

1. Fire exit door opening and closing forces shall comply with IBC Section 1008.1.2.

B. OVERHEAD CLOSERS: Provide non-sized, full feature door closers as hereinafter scheduled. Door closers shall have separate valves regulating speed, latch, and back check position.

C. Provide regular arms for all overhead closers, except where parallel arm closers are schedule to install closers on the side of doors away from corridors and public spaces.

2.08 ACOUSTICAL GASKETS

A. PERIMETER GASKET: Pemko 303 S.

B. AUTOMATIC DOOR BOTTOM: Pemko PDB411 E.

2.09 ASTRAGAL

Pemko 355 S: Clear anodized with gray insert.

2.10 THRESHOLD

4-inch wide, aluminum saddle, Pemko 170A.

2.11 EXIT DEVICE

Von Duprin, XP series with 88K exterior trim.

2.12 FINISH

Stainless steel US32D, unless specified otherwise.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be panted or finished in another way, co-ordinate removal, storage and reinstallation or application of surface protections with finishing Work specified in the Division 09 – Finishes Sections. Do not in-stall surface-mounted items until finishes have been completed on the substrate.

B. Set units level, plumb and true to line and location. Adjust and reinforce the at-tachment substrate as necessary for proper installation and operation.

C. Drill and countersink units which are not factory-prepared for anchorage fasten-ers. Space fasteners and anchors in accordance with industry Standards.

3.02 HARDWARE APPLICATION

A. DOOR CLOSERS

1. General: Verify each head condition prior to furnishing door closers; make required modifications or changes due to detailed conditions.
2. Surface mounted on door: Surface shoe application for standard operation and soffit plate application for parallel arms.
3. Install on steel doors with factory-supplied screws or particle board screws on wood doors.

B. DOOR TRIM

1. Install acoustical gaskets on steel doors with flathead stainless steel screws.
2. Install astragal to interior face of inactive leaf.

C. THRESHOLDS: Set in single component grey colored polyurethane sealant and caulk all perimeter joints to provide watertight installation.

3.03 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. FINAL ADJUSTMENT: Wherever hardware installation is made more than one month prior to Acceptance or occupancy of a space or area, return to the Work during the week prior to Acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area.

1. Clean operating items as necessary to restore proper function and finish of hardware and doors.
2. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.04 POST-OCCUPANCY SERVICES

A. Approximately six months after Substantial Completion, the Installer shall return to the Project and make any necessary adjustments to the hardware to restore proper operational function of doors and hardware.

B. Consult with and instruct Owner’s personnel in any recommended additions or maintenance procedures.

C. Replace hardware items that have deteriorated or failed due to faulty design or installation.

D. Prepare a written report of current or predictable problem(s) (of a substantial nature) in the hardware performance.

E. If there is a hardware problem the Installer cannot resolve, the finish hardware supplier and a representative of the manufacturer of the product concerned shall be contacted. At a mutually convenient time, the Installer, the hardware supplier and the manufacturer's representative shall meet at the Project Site to review and try to resolve the problem. This meeting shall be at no charge to the Owner or Contractor unless the problem is determined to be the result of faulty installation.

3.05 HARDWARE GROUPS

A. ELECTRICAL AND PIPE GALLERY ROOM DOORS

Quantity	Hardware Description
1-1/2 pr	Butt Hinges
1 ea	Closer
1 ea	Exit device with Lockset
1 ea	Threshold
1 ea	Kick Plate
1 ea	Acoustical Gasket

B. ENGINE ROOM DOORS

Quantity	Hardware Description
3 pr	Butt Hinges
1 ea	Closer
1 ea	Lockset
2 ea	Bolts
1 ea	Threshold
1 ea	Astragal
1 ea	Kick Plate
1 ea	Acoustical Gasket

END OF SECTION

SECTION 08 91 00
LOUVERS AND VENTS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes the following:

1. Fixed, formed-metal louvers.

B. Related Sections include the following:

1. Section 23 30 00 – HVAC Air Distribution.

1.02 SUBMITTALS

See requirements in section 23 30 00 – HVAC Air Distribution; 1.02 Required Submittal Data.

1.03 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. SMACNA STANDARD: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.04 PROJECT CONDITIONS

A. FIELD MEASUREMENTS: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 : PRODUCTS

2.01 INTAKE AND EXHAUST AIR LOUVERS

See requirements in Section 23 30 00 HVAC Air Distribution; 2.01 Exterior Wall Louvers.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

END OF SECTION

SECTION 09 91 13
BUILDING EXTERIOR PAINTING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes surface preparation and the application of paint systems on the following building exterior substrates:

1. Concrete.
2. Concrete Masonry Units (CMU).
3. Steel.
4. Wood.

B. Related Requirements:

1. Section 04 22 00 – Concrete Unit Masonry.
2. Section 06 10 00 – Rough Carpentry.
3. Section 08 11 00 – Steel Doors and Frames.
4. Section 09 91 23 – Building Interior Painting.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 09 – Finishes of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1. ASTM Standards
   a. D523 Standard Test Method for Specular Gloss.
2. Master Painter Institute
   a. MPI Approved Products List.

1.03 DEFINITIONS

A. GLOSS LEVEL 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. GLOSS LEVEL 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. GLOSS LEVEL 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

D. GLOSS LEVEL 5: 35 to 70 units at 60 degrees, according to ASTM D523.

E. GLOSS LEVEL 6: 70 to 85 units at 60 degrees, according to ASTM D523.

F. GLOSS LEVEL 7: More than 85 units at 60 degrees, according to ASTM D523.

1.04 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following for each type of product:

1. Samples for Initial Selection: For each type of topcoat product.
2. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
    a. Submit Samples on rigid backing, 8 inches square.
    b. Step coats on Samples to show each coat required for system.
    c. Label each coat of each Sample.
    d. Label each Sample for location and application area.
3. Product List: For each product indicated, include the following:
    a. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
    b. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
    c. VOC content.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: Provide 1 gal. of each material and color applied. Verify Owner’s requirements before ordering and supplying.

1.06 QUALITY ASSURANCE

A. MOCKUPS: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Owner will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
    a. Vertical and Horizontal Surfaces: Sample size to be determined.
2. Final approval of color selections will be based on mockups.
    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Owner at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 : PRODUCTS

2.01 MANUFACTURERS

A. MANUFACTURERS: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Benjamin Moore & Co.

2. Kelly-Moore Paints

3. Miller Paint

4. Rodda Paint Co.

5. Sherwin-Williams Company (The)

6. Or equal.

B. PRODUCTS: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.02 PAINT, GENERAL

A. MPI STANDARDS: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. MATERIAL COMPATIBILITY

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC CONTENT: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. COLORS

1. As selected by Owner from manufacturer's full range.

2. Doors, frames, gutters, downspouts, louvers to match standing seam roof cover as determined by Owner.

2.03 PRIMERS/SEALERS

A. PRIMER, BONDING, WATER BASED: MPI #17.

B. WOOD-KNOT SEALER: Sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.

2.04 METAL PRIMERS

Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.

2.05 WOOD PRIMERS

Primer, Latex for Exterior Wood: MPI #6.

2.06 WATER-BASED PAINTS

A. LATEX, EXTERIOR SEMI-GLOSS (GLOSS LEVEL 5): MPI #11.

B. LIGHT INDUSTRIAL COATING, EXTERIOR, WATER BASED, SEMI-GLOSS (GLOSS LEVEL 5): MPI #163.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. MAXIMUM MOISTURE CONTENT OF SUBSTRATES: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.
2. Masonry (CMU): 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of existing paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
2. SSPC-SP 2, "Hand Tool Cleaning."

D. SHOP-PRIMED STEEL SUBSTRATES: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

E. WOOD SUBSTRATES

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Other than building components, paint the following work where exposed to view:

1. Equipment.
2. Uninsulated metal piping.
3. Pipe hangers and supports.

3.04 FIELD QUALITY CONTROL

A. DRY FILM THICKNESS TESTING: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Engineer, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINTING SCHEDULE

A. STEEL SUBSTRATES: Including New Door and Frames,

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, alkyd, anti-corrosive for metal, MPI #79.

b. Prime Coat: Shop primer specified in Section where substrate is specified.

c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5), MPI #163.

B. WOOD SUBSTRATES: Including wood trim.

1. Latex System:

a. Prime Coat: Primer, latex for exterior wood, MPI #6.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

END OF SECTION

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SECTION 09 91 23
BUILDING INTERIOR PAINTING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes surface preparation and the application of paint systems on building interior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Wood.
5. Gypsum board.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 04 22 00 – Concrete Unit Masonry.
2. Section 06 10 00 – Rough Carpentry.
3. Section 08 11 00 – Steel Doors and Frames.
4. Section 09 21 00 – Gypsum Board Assembly.
5. Section 09 91 13 – Building Exterior Painting.

1.02 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 09 – Finishes of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1. ASTM Standards
   a. D523 Standard Test Method for Specular Gloss.
2. Master Painter Institute
   a. MPI Approved Products List.

1.03 DEFINITIONS

A. GLOSS LEVEL 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. GLOSS LEVEL 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. GLOSS LEVEL 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. GLOSS LEVEL 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. GLOSS LEVEL 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. GLOSS LEVEL 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. GLOSS LEVEL 7: More than 85 units at 60 degrees, according to ASTM D523.

1.04 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following for each type of product:

1. Preparation requirements and application instructions.
2. Samples for Initial Selection: For each type of topcoat product.
3. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
    a. Submit Samples on rigid backing, 8 inches (200 mm) square.
    b. Step coats on Samples to show each coat required for system.
    c. Label each coat of each Sample.
    d. Label each Sample for location and application area.
4. Product List: For each product indicated, include the following:
    a. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
    b. VOC content.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 1 gal. (3.8 L) of each material and color applied. Verify with Owner as to quantity required prior to ordering.

1.06 QUALITY ASSURANCE

A. MOCKUPS: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Owner or Engineer will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
    a. Vertical and Horizontal Surfaces: Sample size to be determined.

2. Final approval of color selections will be based on mockups.

    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Owner at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 : PRODUCTS

2.01 MANUFACTURERS

A. MANUFACTURERS: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Benjamin Moore & Co.
2. Kelly-Moore Paints
3. Miller Paint
4. Parker Paint Mfg. Co. Inc.
5. Pratt & Lambert
6. Rodda Paint Co.
7. Sherwin-Williams Company (The)
8. Or equal.

2.02 PAINT, GENERAL

A. MPI STANDARDS: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. MATERIAL COMPATIBILITY

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. COLORS: As selected by Owner from manufacturer's full range.

2.03 PRIMERS/SEALERS/FILLERS

A. PRIMER SEALER, LATEX, INTERIOR: MPI #50.

B. PRIMER, ALKALI RESISTANT, WATER BASED: MPI #3.

C. PRIMER, LATEX, FOR INTERIOR WOOD: MPI #39.

D. BLOCK FILLER FOR CMU WALLS: MPI #4.

2.04 METAL PRIMERS

FACTORY APPLIED PRIMER: match.

2.05 WATER-BASED PAINTS

LATEX, INTERIOR, SEMI-GLOSS, (GLOSS LEVEL 5): MPI #54.

2.06 CONCRETE FLOOR

SEALER, WATER BASED, FOR CONCRETE FLOORS: MPI #99.

2.07 SOURCE QUALITY CONTROL

A. TESTING OF PAINT MATERIALS: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.

3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove non-complying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. MAXIMUM MOISTURE CONTENT OF SUBSTRATES: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. GYPSUM BOARD SUBSTRATES: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. CONCRETE SUBSTRATES: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. MASONRY SUBSTRATES: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. STEEL SUBSTRATES: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

G. SHOP-PRIMED STEEL SUBSTRATES: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. WOOD SUBSTRATES

1. Scrape and clean knots and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. In addition to building components, paint the following work where exposed:

1. Equipment
2. Uninsulated metal piping.
3. Pipe hangers and supports.

3.04 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Engineer, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.05 INTERIOR PAINTING SCHEDULE

A. CONCRETE SUBSTRATES, TRAFFIC AND NON-TRAFFIC SURFACES

1. Water-Based Clear Sealer System:
   a. First Coat: Sealer, water based, for concrete floors and lower interior walls, MPI #99.
   b. Topcoat: Sealer, water based, for concrete floors and lower interior walls, MPI #99.

B. CMU

1. Latex System
   a. Prime Coat: Block filler, latex interior, MPI #4.
   b. Intermediate Coat: Latex interior, matching topcoat.
   c. Top Coat: Latex interior, semi-gloss (Gloss Level 5), MPI #54.

C. STEEL SUBSTRATES

1. Latex over Alkyd Primer System:
   a. Prime Coat: Shop primer specified in Section where substrate is specified.
   b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.

D. WOOD SUBSTRATES

1. Latex System:

a. Prime Coat: Primer, latex, for interior wood and wood fiber cement, MPI #39.

b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.

E. GYPSUM BOARD (WALLS AND CEILINGS) SUBSTRATES

1. Latex System:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.

b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.

END OF SECTION

SECTION 09 96 00
PAINTING AND PROTECTIVE COATINGS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies high performance industrial coatings and their surface preparation for non-building applications.

B. Definitions: Coating systems include surface description, surface preparation, required dry film thickness (DFT), and the number and application procedure of the prime and finish coatings as specified in the Coating System Specifications Sheets, located in Paragraph 2.02.

Field coating is the application or the completion of application of the coating system after installation of the surface at the site of the work.

Installer or applicator is the person actually installing or applying the product in the field at the Project site. Installer and applicator are synonymous.

1.02 STANDARDS AND CODES

A. REFERENCES

1. ASTM International (ASTM).
2. International Concrete Repair Institute (ICRI).
3. National Association of Corrosion Engineers International (NACE).
4. National Association of Pipe Fabricators (NAPF).
5. NSF International (NSF).
6. The Society for Protective Coatings (SSPC).

B. STANDARDIZATION: Materials, supplies, and articles provided shall be the standard products of manufacturers. Paints in a particular coating system shall be the products of a single manufacturer.

Requests for substitutions, in accordance with Section 1-06 of the WSDOT Division 1 Special Provisions, will be considered, provided the following minimum conditions are met:

1. The proposed coating system shall use an equal or greater number of separate coats to achieve the required dry film thickness.
2. The proposed coating system shall use coatings of the same generic type.
3. Requests for substitution shall have directions for application and descriptive literature that includes generic type, nonvolatile content by volume, and information confirming that the substitution is equal to the specified coating system.

1.03 QUALIFICATIONS

A. Coating manufacturer's authorized representative shall provide written statement attesting that applicator has been instructed on proper preparation, mixing, and application procedures for coatings specified.

B. Applicators shall have a minimum of ten (10) years of experience in application of similar products on similar project:

1. Provide references for minimum of three (3) different projects completed in the last five (5) years with similar scope of work.
2. Include name and address of project, size of project in value (painting), and contact person.

1.04 SUBMITTALS

A. In accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Applicator experience qualifications:
    a. No submittal information will be reviewed until the Engineer has received and approved applicator qualifications.
2. Manufacturer's specifications for each coating system including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's application instructions.
    c. Manufacturer's surface preparation instructions.
    d. If products being used are manufactured by a Company other than listed in Paragraph 2.02 of this Section, provide complete individual data sheet comparison of proposed products with specified products including application procedure, coverage rates, and verification that product is designed for intended use.
    e. Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.
    f. Coating manufacturer's recommendation on abrasive blasting.
    g. Manufacturer's recommendation for universal barrier coat.
    h. Manufacturer's recommendation for providing temporary or supplemental heat or dehumidification or other environmental control measures.
    i. A list of materials proposed to be used.
3. Manufacturer’s color charts. Basic colors are indicated in Paragraph 3.05. Final color selection shall be made by the Owner from the submitted color charts.
4. Manufacturer's statement regarding applicator instruction on product use.

5. Informational Submittals:

    a. Approval of application equipment.

    b. Applicator's daily records:

        1) Submit daily records at the end of each week in which painting work is performed unless requested otherwise by the Engineer's on-site representative.

1.05 DELIVERY AND STORAGE

A. Materials shall be delivered to the job site in their original, unopened containers, labeled as follows:

1. Name or type number of material.
2. Manufacturer's name and item stock number.
3. Date of manufacture.
4. Contents, by volume, of major constituents.
5. Warning labels.
6. Volatile organic compound (VOC) content.
7. Storage life.
8. Any special instructions or directions.

B. Paints shall be stored in enclosed structures and shall be protected from weather and excessive heat or cold, and maintained within the storage temperature range recommended by the paint manufacturer, but in no case stored where the temperature is lower than 40^{o}F or greater than 100^{o}F.

1. Paint material storage facility shall be monitored with a high-low recording thermometer device.
2. Flammable materials shall be stored in accordance with State and local codes.

C. Materials exceeding storage life recommended by the manufacturer shall be removed from the site.

1.06 SPARE PAINT SUPPLIES

The Contractor shall provide one unbroken gallon container of each color and type of coating, solvent, and thinner required in the Specification. These spare paint supplies shall be stored as directed by the County Construction Manager.

PART 2 : PRODUCTS

2.01 MATERIALS

A. GENERAL: Coating system shall not be applied until the Engineer has inspected the surface to be coated.

B. COATING SYSTEMS: Unless otherwise specified, prime coatings may be shop- or field-applied. Shop-applied primer shall be compatible with the specified system. Field coating signifies that coating is applied in place, after installation of the surface. If the shop coating meets the requirements of this Section, the field coating may consist of touching up the shop prime coat to achieve the film thickness, continuity, and coating specified in the Coating System Specification sheets. Damaged and poorly applied shop coatings that do not meet the requirements of this Section shall be removed and the surfaces recoated in accordance with the Coating System Specification Sheets.

Surface preparation shall be as specified for each paint system and in accordance with Paragraph 3.01. Number of coats specified in each system shall be the minimum number of coats applied to provide the required dry film thickness.

For unspecified materials such as thinner, provide manufacturer's recommended products.

C. MANUFACTURERS: As specified for each Coating System or accepted equal.

2.02 COATING SYSTEM SPECIFICATIONS

Coating System	**A**
Coating Material:	Modified Polyamine Epoxy
Surfaces:	Concrete
Surface Preparation:	1. Allow precast concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness and prepare concrete surfaces in accordance with NACE 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs per 1,000 sq ft in a 24-hour period (Reference ASTM F1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride"). Relative humidity should not exceed 80% (Reference ASTM F2170 "Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes"). Abrasive blast, shot-blast, water jet, or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers, and other contaminants and to provide a minimum ICRI-CSP 3 surface profile. Large cracks, voids, and other surface imperfections shall be filled with a recommended filler or surfacer.
Application:	Factory – Exterior Surfaces Field – Interior Surfaces
Coating System:	
Primer/Finish:	Tnemec Series 141 Epoxoline **(Tnemec 46H-413 Hi-Build Tneme-Tar is an acceptable substitute)*** One coat, 16 mils DFT

Coating System **B**

Coating Material: Aromatic Urethane, Zinc Rich / Polyamidoamine Epoxy / Polycarbamide

Surfaces: Metal

Surface Preparation:

1. Bare ferrous metal surfaces shall be prepared in accordance with SSPC SP-6 (Commercial Blast Cleaning).

2. Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning all surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning).

3. Galvanized or nonferrous surfaces shall be treated with a passivator and vinyl wash primer as recommended by the coating system manufacturer.

4. If smoothing of rough metalwork is necessary, a smoothing cement acceptable to the paint system material manufacturer shall be used.

Application: Field

Coating System:

Primer: Tnemec Series 90-97 Tneme-Zinc
One coat, 2.5 to 3.6 mils DFT
Color: Off-White

Intermediate: Tnemec Series 135 Chembuild
One coat, 4.0 to 6.0 mils DFT
Color: Off-White

Finish: Tnemec Series 750 UVX
Two coats, 2.5 to 5.0 mils DFT per coat
Color: See Paragraph 3.05

Coating System	**C**
Coating Material:	100% Solids High Build Epoxy
Surfaces:	Concrete
Surface Preparation:	Surfaces must be sound and contaminant-free with a surface profile equivalent to a minimum CSP3 to CSP5 in accordance with ICRI Technical Guideline No. 310.2R-2013. Dry abrasive sand with water blast to surface profile as recommended by the manufacturer.
Application:	Field **or factory applied. If factory applied, field coating of joints will be required.***
Coating System:	
Primer:	As recommended by coating system manufacturer
Finish:	Raven 405 Spray apply two coats, 125 mils DFT total Allowed tolerances of plus 40 miles DFT to minus 0 mils DFT Color: Light Blue

Tnemec 218 and Tnemec 436 wet well coatings are not considered equivalent coatings for the interior of wet wells, manholes, or vaults.*

Coating System	**D**
Coating Material:	100% Solids Modified Polyamine Epoxy
Surfaces:	Metal
Surface Preparation:	As recommended by coating system manufacturer.
Application:	Field
Coating System:	
Primer:	As recommended by coating system manufacturer
Finish:	Tnemec Series 435 Perma-Glaze Two coats, 12 to 15 mils DFT per coat Color: See Paragraph 3.05

Coating System	**E**
Coating Material:	Epoxy (per Flygt/Xylem)
Surfaces:	Metal
Surface Preparation:	In accordance with SSPC SP-10 (Near white metal blast)
Application:	Factory Curing as required by coating manufacturer
Coating System:	Xylem Standard Code 08 Coating System
Primer:	Temanyl PVB, one coat 1.6 Mil DFT
Finish:	Duasolid 50, 3 coats 4-5 Mil DFT per coat

PART 3 : EXECUTION

3.01 PREPARATION

A. GENERAL: Surfaces to be coated shall be clean. Before applying coating or surface treatments, oil, grease, dirt, rust, loose millscale, old weathered coatings, and other foreign substances shall be removed except as specified. Oil and grease shall be removed before mechanical cleaning is started. Where mechanical cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded, and free of contaminants that might interfere with the adhesion of the coatings.

Clean cloths and clean fluids shall be used in solvent cleaning. Cleaning and painting shall be scheduled so that dust and spray from the cleaning process will not fall on wet, newly painted surfaces.

The Contractor shall demonstrate that field coating is compatible with factory coating by applying small test patches of specified coating over shop coating.

The Contractor shall pay special attention to painting of existing surfaces adjacent to the new piping and structures. Care shall be taken in surface preparation and finish work to provide a smooth transition from one surface to the other. If necessary, compatible primer shall be used when painting over existing surface.

B. METALLIC SURFACES: Metallic surfaces shall be prepared in accordance with applicable portions of surface preparation specifications of the SSPC. Specific applicable standards are specified in each coating system. The solvent in solvent cleaning operations shall be as recommended by the manufacturer.

Preparation of metallic surfaces shall be based upon comparison with SSPC-Vis-1-67T (ASTM D220), and as described herein. To facilitate inspection, the Contractor shall, on the first day of sandblasting operations, sandblast metal panels to the standards specified. Plates shall measure a minimum of 82 inches by 11 inches. Panels meeting the requirements of the specifications shall be initialed by the Contractor and the Engineer and coated with a clear non-yellowing finish. One of these panels shall be prepared for each type of sandblasting and shall be used as the comparison standard throughout the project.

Ductile iron pipe and fittings to be painted shall be purchased from the manufacturer <u>without</u> the petroleum asphalt coating normally furnished pursuant to AWWA Standards C110, C115, C151 or C153. Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations and NAPF.

Surface preparation for galvanized metal, aluminum, copper, and brass shall be in accordance with SSPC SP-1 (solvent cleaning) and passivated in accordance with the coating manufacturer’s written instructions.

C. PREPARATION OF CONCRETE, MASONRY, AND PLASTER SURFACES: Unless otherwise specified, surfaces which are to be coated shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the coating manufacturer. Moisture content may be tested by the Engineer with a Delmhorst Instrument Company moisture detector or accepted equal. In addition, the surfaces shall be brush treated with a 10 percent muriatic acid solution and thoroughly flushed with water after 10 minutes. (Ten percent acid solution is commercial solution; 30 percent is diluted 2 water to 1 acid.) Loose concrete and laitance shall be removed by sandblasting and chipping, and voids and cracks shall be repaired as approved by the coating manufacturer. Concrete masonry units shall incorporate CMU filler as recommended by the paint manufacturer.

Plaster surfaces shall be dry and clean and free from grit, loose plaster, and surface irregularities. Cracks and holes shall be repaired with acceptable patching materials, keyed to existing surfaces, and sandpapered smooth. Surfaces to be coated with oil or varnish base paints shall be tested for the presence of alkali. If present, the alkali shall be neutralized with acid solution as above.

Surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.

D. PREPARATION OF PLASTIC SURFACES: Plastic surface shall be roughened with sandpaper or steel wool and shall be cleaned with solvent compatible with specified primer.

3.02 APPLICATION

A. WORKMANSHIP: Coated surfaces shall be free from runs, drops, ridges, waves, laps, and brush marks. Coats shall be applied so as to produce an even film of uniform thickness completely coating corners and crevices. Painting shall be performed in accordance with the requirements of SSPC Paint Application Guide.

Each coat of paint shall be applied evenly and sharply cut to line. Care shall be exercised to avoid over-spraying or spattering paint on surfaces not to be coated. Glass, hardware, floors, roofs, and other adjacent areas and installations shall be protected by taping, drop cloths, or other suitable measures.

B. PAINT PROPERTIES, MIXING, AND THINNING: Paint, when applied, shall provide a satisfactory film and smooth even surface, and glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application and adhesion of subsequent coats. Paints shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings consisting of two or more components shall be mixed in accordance with the manufacturer's instructions. Where necessary to suit the conditions of the surface, temperature, weather and method of application, the paint may be thinned immediately prior to use by the addition of not more than one pint of the proper thinner per gallon. Unless otherwise specified, paint shall not be reduced more than necessary to obtain the proper application characteristics. Thinner shall be as recommended by the coating manufacturer.

C. ATMOSPHERIC CONDITIONS: Unless otherwise specified or required for certain water-thinned paints, paints shall be applied only to surfaces that are dry, and only under such combination of humidity and temperatures of the atmosphere and surfaces to be painted as well cause evaporation rather than condensation. Paint shall not be applied during rainy, misty weather, or to surfaces upon which there is frost or moisture condensation. During damp weather, when the temperature of the surface to be coated is within 10°F of the dew point, the surfaces shall be heated to prevent moisture condensation thereon. Bare metal surfaces, except those which may be warped by heat, may be dehydrated by flame-heating devices immediately prior to paint application. During painting, and for a period of at least 8 hours after the paint has been applied, the temperature of the surfaces to be painted, the painted surfaces, and the atmosphere in contact shall be maintained at or above 40°F and 10°F above the dew point. Paint, when applied, shall be approximately the same temperature as that of the surface on which it is applied. Fans or heaters shall be used inside enclosed areas where conditions causing condensation are severe.

D. METHOD OF PAINT APPLICATION: Where two or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors. Color additives shall not contain lead or any lead compound which may be destroyed or affected by hydrogen sulfide or any gas likely to be found in wastewater facilities.

Electrical and mechanical equipment, on which the manufacturer's coating is acceptable, shall be touch-up primed and painted with two coats of the specified coating system to match the color schedule. This does not apply to electrical and instrumentation equipment specified in Division 26 – Electrical.

Paint shall not be applied to a surface until it has been prepared as specified. Unless otherwise specified, the primer or first coat shall be applied by brush to ferrous surfaces, except subsequent coats for blast-cleaned ferrous surfaces, that may be either brush- or spray-applied. Unless otherwise specified, prime and finish coats shall be applied at the rate recommended by the manufacturer for the service involved. After the prime coat is dry, suction spots shall be touched up before succeeding coats are applied. Unless otherwise specified, coats for concrete and masonry shall be brushed or rolled.

Unless otherwise specified, finish coats shall not be applied until other work in the area is complete, and until the prime and intermediate coats have been inspected.

E. FILM THICKNESS AND CONTINUITY: Coating system thickness is the total thickness of primer and finish coats and does not include passivators or sealers.

The surface area covered per gallon of paint for various types of surfaces shall not exceed those recommended by the manufacturer. The first coat on metal surfaces refers to the first full paint coat and not to conditioning or other pretreatment applications. Unless otherwise specified, the average total thickness (dry) of any completed protective coating system on exposed metal surfaces shall be not less than 1.25 mils per coat. The minimum thickness at any point shall not deviate more than 25 percent from the required average. Unless otherwise specified, no less than two coats shall be applied.

F. SPECIAL REQUIREMENTS: Hangers and supports shall be coated, except for the final coat, prior to installation. Except for those to be filled with grout, the underside of ungalvanized equipment bases and supports shall be coated with at least two coats of rust inhibiting primer prior to setting the equipment in place. Bolt and bolt holes in flanges (such as those used with couplings or wafer-type valves where holes and bolts as finally installed will be exposed to weather or moisture) shall be painted prior to assembly to prevent rusting of the unprotected metal.

3.03 CLEANUP

Upon completion of painting, the Contractor shall remove surplus materials, protective coverings, and accumulated rubbish, and thoroughly clean all surfaces and repair any overspray or other paint-related damage.

3.04 COATING SYSTEMS SCHEDULE

A. In the following schedule, coating system letters shall conform to those listed in the Coating System Specification sheets.

B. Unless shown otherwise, surface coatings shall be semigloss, except that ceilings shall be coated with flat coatings to match wall areas.

C. Surfaces to be coated and coating systems to be used are described below. The final coat shall be applied only after all other work, including punch list items, has been completed.

Surface			Coating System
1.	Metal Work: Equipment, including metal base and guards; conduits, piping; appurtenances, including grilles and louvers; doors; electrical, pneumatic, and instrumentation control panels and stations, including supports. Refer to equipment specifications for exceptions.		
	a.	Iron and steel (includes galvanized) (except non-ferrous and stainless), exposed above ground or in vault structures (not buried)	B (except as indicated under b. & c.)
	b.	Iron and steel piping and appurtenances located in the wet well	D (except as indicated under c.)
	c.	Submersible pumps	E
2.	Concrete, Grout, and Masonry:		
	a.	Exterior concrete exposed slabs and surfaces	Unpainted
	b.	Exterior concrete buried surfaces of wet well, manholes, valve vaults	A
	c.	Interior concrete/grouted surfaces of new and existing wet wells	C
	d.	Interior concrete/grouted surfaces of new and existing manholes	C
	e.	Interior concrete surfaces of valve vault	A or C
3.	Materials Not Requiring Paint		
	a.	Rubber, stainless steel, copper pipe, PVC pipe, and fiberglass fabrications.	—
	b.	Labels and Nameplates: Do not paint over Underwriters Laboratories Factory Mutual, or other code-required labels or equipment name, identification, performance rating, nomenclature plates.	—
	c.	Pre-Finished Items, except as damaged, including: (1) acoustic materials (2) finished mechanical and electrical equipment (3) light fixtures (4) switchgear (5) distribution cabinets (6) operating louvers	—
	d.	Metal Surfaces, including: (1) aluminum railing, ladders, hatlines, light poles (2) stainless steel (3) chromium plate (4) copper (5) bronze (6) brass (7) aluminized and galvanized (and vinylized) chainlink fabric fences, gates, and closures (8) Duct silencers and motor-operated dampers	—

Surface	Coating System
e. Moving Parts of Operating Equipment such as the following: (1) valve and damper operators (2) linkages (3) sensing devices (4) motor and fan shafts (5) gears	—

3.05 COLOR SCHEDULE

The following table is a listing of colors for coatings covered in this Section and factory-applied finishes. It is intended to provide a general indication of the required color. The final color selection will be made by the Owner from the manufacturer's standard color chart provided by the Contractor. Where an exact match to other surfaces is specified, a custom-mixed color may be required.

Surface	Color
Interior Concrete Wet Well (New and Existing)	Light Blue or Gold
Sewage Pump, Piping, Valves, and Accessories	Light Gray

For surfaces that require coating, but no color is listed, the color shall be selected by the Owner. The Contractor shall anticipate that additional colors (standard or custom-mixed) may be required.

END OF SECTION

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SECTION 10 14 00
SIGNAGE

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This Section includes identifying devices and signage.

1.02 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Drawing showing layout, and letter size and style.
2. Manufacturer's installation instructions.

PART 2 : PRODUCTS

2.01 FIBERGLASS SIGNS (TYPE A)

A. MATERIAL: Three-ply laminated fiberglass, minimum 1/8-inch thick, with contrasting color core message layer between two clear weather-resistant surface layers.

B. MANUFACTURERS

1. SETON, customizable signs
2. Or accepted equal.

2.02 IDENTIFICATION LABELS

A. PIPE LABELS AND FLOW DIRECTION ARROWS

1. Lettering and Arrows: White print on blue or red background, black print on yellow, green, or gray background.
2. Background: Color as indicated on the Piping Specification sheets in Section 22 13 11 – Piping Systems.
3. Material: Manufacture from or encase in outdoor grade plastic or vinyl that will resist damage or fading from washdown, sunlight, mildly corrosive atmosphere, dirt, grease, and abrasion.
4. Label, Lettering Size, and Color: ANSI A13.1.
5. Message: Legend indicated on the Piping Specification sheets in Section 22 13 11 – Piping Systems.
6. Labels
    a. *Snap-Around type:* Size for finished outside diameter of pipe and insulation.
    b. Firmly grip pipe so labels remain fixed in vertical pipe runs.

7. Manufacturers and Products
   a. T&B/Westline, Rariton, NJ, Model WSS Snap-Around
   b. Seton Name Plate Corp., New Haven, CT, Setmark Series
   c. Or accepted equal.

B. EQUIPMENT LABELS

1. Lettering: Black bold face, ¾-inch minimum height.
2. Background: OSHA safety yellow.
3. Materials: Either of the following:
   a. Aluminum or stainless steel base with a baked-on finish that is suitable for use on wet, oil, exposed, abrasive, and corrosive areas.
   b. Fiberglass with fiberglass-encased lettering.
4. Furnish 1-inch margin on each end of label for mounting. On fiberglass labels, furnish grommets at each end for mounting.
5. Size
   a. 2-inch minimum and 3-inch maximum high by 14-inch minimum and 18-inch maximum long.
   b. Furnish same size base dimensions for all labels.
6. Message: Equipment names.
7. Manufacturers and Products:
   a. T&B/Westline Co., Rariton, NJ, Type KQ
   b. Seton Name Plat Corp., New Haven, CT, Style EB
   c. W.H. Brady Co., Milwaukee, WI, Fiber-Shield
   d. Or accepted equal.

2.03 SIGN SCHEDULE

Provide signs in accordance with the Sign Schedule included herein.

SIGN SCHEDULE[5]									
Sign					**Lettering**				
Type	**Qty**	**Width**	**Height**	**Color**	**Height**	**Style**	**Color**	**Heading[1]**	**Message**
A	3[2]	14”	10”	Yellow	1” min.	Helvetica	Black	CAUTION	THIS EQUIPMENT STARTS AND STOPS AUTOMATICALLY
A	4[3]	14”	10”	White	1” min.	Helvetica	Black	DANGER	HIGH VOLTAGE ELECTRICAL EQUIPMENT
A	6[4]	10”	7”	White	1” min.	Helvetica	Black	DANGER	CONFINED SPACE DO NOT ENTER

Notes:

1) Use standard OSHA format for Headings.
2) 3 signs at Pump Station 19; 0 signs at Pump Station 31.
3) 3 signs at Pump Station 19; 1 sign at Pump Station 31.
4) 4 signs at Pump Station 19 (located on each access hatch); 2 signs at Pump Station 31 (located on wet well and valve vault access hatches).
5) Salvage and reuse the existing address signs for Pump Station 19 and Pump Station 31.

PART 3 : EXECUTION

3.01 GENERAL

The location of identifying devices shown on the Drawings is approximate only. The Contractor shall temporarily attach identifying devices using masking tape. The Contractor shall then request a review of the proposed location by the Owner. The Contractor shall anticipate that delays or hindrance may result from this review. The Contractor shall permanently install the identifying devices in the location required by the Owner.

3.02 SIGNS

A. Mounting location to be determined in the field by the Engineer or Owner.

B. Mount signs using stainless steel components (U-bolts, screws, nuts, bolts, etc.), unless indicated otherwise on the Drawings.

3.03 IDENTIFICATION LABELS

A. PIPE LABELS AND FLOW INDICATION ARROWS

1. Locate all connections to equipment, valves, or branching fittings at wall boundaries.
2. At intervals along piping not greater than 18 feet on center, with at least one label applied to each exposed horizontal and vertical run of pipe.
3. At exposed piping not normally in view, such as above suspended ceilings and in closets and cabinets.
4. Supplementary Labels: Provide to Owner those listed on Piping Schedule that do not receive arrows.
5. Application: To pipe only after painting in vicinity is complete, or as approved by Owner's Representative.
6. Installation: In accordance with manufacturer's instructions.

B. EQUIPMENT LABELS

1. Locate and Install: On equipment or concrete equipment base where visible.
   a. Install submersible pump equipment labels in location as directed by Owner in the field.
2. Anchor to equipment or base for easy removal and replacement with ordinary hand tools.

END OF SECTION

SECTION 10 44 00
FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes the following:

1. Fire extinguishers.
2. Mounting brackets.

1.02 SUBMITTALS

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Product data for each type of product specified. For fire extinguisher cabinets, include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

1.03 STANDARDS AND CODES

A. Referenced Standards and Publications: This Section incorporates by reference the revision of the following documents in effect 30 days prior to bid. It is part of all sections in Division 10 – Specialties of the Specifications as referenced or modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1. SINGLE-SOURCE RESPONSIBILITY: Obtain fire extinguishers and cabinets through one supplier from a single manufacturer.
2. UL-LISTED PRODUCTS: Fire extinguishers UL-listed and bear UL Listing Mark for type, rating, and classification of extinguisher.

PART 2 : PRODUCTS

2.01 MANUFACTURER

A. AVAILABLE MANUFACTURERS: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:

1. Amerex Corp.
2. Ansul Fire Protection, Wormald US, Inc.
3. Walter Kidde, Division of Kidde, Inc.
4. Approved equal.

2.02 FIRE EXTINGUISHERS

A. GENERAL: Provide fire extinguisher cabinets where indicated, in colors and finishes selected by Engineer from manufacturer's standard. Fire extinguisher cabinets shall comply with requirements of governing authorities for all fire extinguishers in outside locations. Fire extinguishers located indoors do not require cabinets.

1. Abbreviations indicated below identify extinguisher types related to UL classification and rating system and not necessarily to type and amount of extinguishing material contained in extinguisher.

B. MULTIPURPOSE DRY CHEMICAL TYPE: UL-rated 3A-40 B:C, 6-lb nominal capacity, in enameled steel container.

1. Provide increased capacity or higher rating if noted otherwise on plans

C. MOUNTING BRACKET: Provide manufacturer's recommend wall mounting system.

1. For outdoor locations, provide fire extinguisher manufacturer's recommended cabinet to mitigate dust, corrosion, and animals. Provide tempered glass door with metal cabinet enclosure.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Install items included in this Section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

B. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

C. Fire extinguishers shall be provided at the following locations:

1. Pump Station 19 Engine Room – provide one (1).
2. Pump Station 19 Piping Room – Provide one (1)
3. Pump Station 19 Electrical Room – provide one (1)
4. Pump Station 19 Fuel Tank Area – provide one (1).
5. Pump Station 31 Electrical Canopy – provide one (1).

END OF SECTION

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Work includes complete mechanical systems indicated on the Drawings and specified. The Bid and Contract Documents and General Requirements of the specification are a part of this division of the Specification. Where the word “provide” is used, it means “furnish and install complete and ready for use.” Provide supervision, labor, material, equipment, and machinery necessary to complete the mechanical systems. Provide finished work, tested, and ready for operation.

1.02 DRAWINGS

A. Drawings are diagrammatic, indicating the general arrangement of systems and work, and do not attempt to show exact details or all offsets in piping and ductwork. Do not scale Drawings. Examine the architectural Drawings for exact location of fixtures and equipment. Where they are not definitely located, obtain this information from the Engineer.

B. Follow Drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom. If space conditions appear inadequate, notify the Engineer before proceeding with the work. Make reasonable modifications in the work without extra cost as needed to prevent conflict with work of other trades and for proper execution of the work.

1.03 EQUIPMENT DEVIATIONS

A. Specific manufacturers and model numbers are noted to indicate a standard of design and are not intended to be restrictive.

B. Where the term “or approved equal” is used, alternative and/or substitute products will be considered only prior to the bid date (Prior Approval). Where the term “or equal” is used, approval of alternative and/or substitute products may be requested by the Contractor after the bid date. Submittal, review, and potential approval of alternative and/or substitute products will be considered and executed only under terms and conditions specified in Section 1-06 – Control of Materials.

C. When submitting an alternative and/or substitute product, the Contractor shall include complete product literature of original specified item.

D. Provide redesign to any part of the work resulting from the use of equipment and material other than specified or indicated on the Drawings. Obtain approval of redesign from the Engineer. Redesign cost and additional construction cost resulting from the redesign shall be at the Contractor’s expense.

1.04 GENERAL REQUIREMENTS FOR SHOP DRAWING AND SUBMITTAL DATA

A. Check and verify field measurements and requirements. Submit promptly, so as not to delay the work, one copy, checked and approved by the Contractor, of all shop drawings, submittal data, and layout drawings. At the discretion of the Engineer, the Contractor may submit PDF submittals in lieu of paper copies. Confirm with the Engineer prior to submitting. The Engineer will check and review, with reasonable promptness, the shop drawings and submittal data only for conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Make corrections required by the Engineer and resubmit to the Engineer *one* corrected copy. The Engineer's review of the shop drawings and submittal data shall not relieve the Contractor from responsibilities for deviation from the Contract Documents unless the Contractor has in writing called to the Engineer's attention deviation at the time of submission and secured the Engineer's written approval, nor shall it relieve the Contractor from responsibility for errors in the shop drawings and submittal data.

B. The shop drawings and submittal data for the material and equipment shall be submitted at one time. Each copy shall be in a 3-ring binder, indexed, and properly labeled indicating specific material or equipment for which it is to be used and the Specification section and paragraph number relating to the submitted item.

C. Review, approve, and stamp shop drawings and submittal data before submission to the Engineer. Notify the Engineer, in writing, of any deviation from the requirements of the Contract Documents.

D. Failure to submit shop drawings and submittal data in ample time for checking and review shall not entitle the Contractor to an extension of contract time.

E. See individual Specification sections for required submittal data.

1.05 REQUIRED SUBMITTAL DATA FOR THIS SPECIFICATION SECTION

A. In accordance with the provisions of the WSDOT Division 1 Special Provisions, submit the following:

1. Product data for each type of product specified.

    a. Valves.

1.06 CODES AND STANDARDS

A. Give necessary notices, obtain permits and pay taxes, fees and other costs, including utility connections or extensions for the work. File necessary drawings, prepare documents, and obtain necessary approvals of governmental departments having jurisdiction. Include all costs associated with notices; permits; taxes; fees; utility connections or extensions; government approvals; and other related costs in original bid. Obtain required certificates of inspection for work and deliver to the Engineer before request for acceptance and final payment for the work.

B. Comply with laws, ordinances, rules, regulations, and lawful orders of any public authority bearing on the performance of the work. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Engineer in writing and any necessary changes shall be accomplished by appropriate modification. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without notice to the Engineer, he shall assume full responsibility, and shall bear all costs.

C. Material and equipment within the scope of the Underwriters Laboratories (UL) Testing Laboratory Service shall be listed by the UL for the purpose for which they are used and shall bear their listing mark.

D. UL approval for gas valves.

PART 2 : PRODUCT

2.01 GENERAL

A. Provide valves of same manufacturer throughout where possible.

B. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

C. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves, unless indicated otherwise.

D. Thread pipe sizes 2-inches and smaller.

E. Flange pipe sizes 2½-inches and larger.

F. Solder or thread-to-solder adapters for copper tubing.

2.02 BALL VALVES

2-Inches and Smaller: 2 piece cast bronze body and end-piece ASTM B584 (alloy shall contain no more than 15% zinc), full port Solid B16 Chrome Plated brass ball, blowout proof; B16 brass stem, Teflon seats and seals, threaded ends, 600 psi CWP, Class 150. Where piping is insulated, valves shall be provided with 2" extended handles of non-thermal conductive material and a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Provide with memory stops, which are fully adjustable after insulation is applied, NIBCO T-585-70; Apollo 77C-100, Milwaukee BA-400; equal of Red-White, Crane, Watts; or other approved equal.

2.03 SERVICE SADDLES

A. Saddle body shall be cast from ductile iron meeting or exceeding ASTM A536, Grade 65-45-12.

B. Gasket shall be nitrile butadiene rubber (NBR) compounded for water and sewer service and tolerance of petroleum products in accordance with a ASTM D2000 MBC 610.

C. Straps shall be Stype 304 heavy gauge stainless steel per ASTM A240. Straps shall be two inches wide to spreadout clamping forces on the pipe and passivated for corrosion resistances.

D. Bolts and nuts shall be 5/8" UNC roll thread Type 304 stainless steel with heavy hex nuts. Rods for bolts shall be per ASTM A240 and nuts shall be per ASTM A194. All welds shall be fully passivated for enhanced corrosion resistance. Nuts shall be coated to prevent galling.

E. Washers shall be flat, Type 304 heavy gauge stainless steel.

F. Fusion bonded epoxy coatings shall be shop applied to cast parts for corrosion protection in transit.

G. ACCEPTABLE MANUFACTURERS

1. Romac Industries, Inc Style 202S.
2. Smith Blair Nidek 317.
3. Accepted equal.

2.04 FLOOR DRAINS

A. Floor drains shall be cast into valve vault floor by precast manufacturer and in the concrete slab(s) by the Contractor.

B. Coated cast iron body with polished nickel bronze strainer.

C. 8-inch minimum diameter strainer.

D. Floor drain connection type and size to match pipe diameter and type as shown on the Drawings.

E. MANUFACTURER: Zurn ZN-415B or accepted equal.

PART 3 : EXECUTION

3.01 COOPERATION WITH OTHER TRADES

A. Give full cooperation to other trades and furnish in writing to other trades, with copies to the Engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Where plumbing work will be installed in close proximity to, or will interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment. *Prepare composite working drawings and sections at a suitable scale, not less than ¼-inch = 1-foot - 0-inches, clearly showing how the mechanical work is to be installed in relation to the work of other trades. * If work is installed before coordinating with other trades, or if it causes any interference with work of other trades, make the necessary changes in the work to correct the conditions and bear all costs.

C. Furnish to other trades necessary templates, patterns, setting drawings, and shop details for the proper installation of work and for coordinating adjacent work.

3.02 SAFETY

The Engineer has not been retained to provide design and construction services relation to the Contractor's safety precautions, or to means, methods, techniques, sequences, or procedures required for the Contractor to perform his work. The Contractor is solely and completely responsible for conditions of the job site, including safety of persons and property during performance of work. This requirement applies continuously and is not limited to normal working hours. Comply with "Safety and Health Regulations for Construction," Volume 36, No. 75, Part II of the Federal Register by the US Department of Labor. Provide required safety measures and consult with the State or Federal safety inspector for interpretation whenever in doubt as to whether safe conditions do or do not exist or whether compliance with State or Federal regulations exists.

3.03 PROTECTION

A. Protect work and material from damage and be liable for damage.

B. Be responsible for work and equipment until finally inspected, tested, and accepted; protect work against theft, injury, or damage; and carefully store material and equipment received on site that are not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of obstructing material.

3.04 MATERIAL AND WORKMANSHIP

A. Materials and equipment required for the work shall be new and shall be furnished, delivered, erected, installed, connected and finished in every detail; and shall be selected and arranged to fit properly into the building spaces. Where no specific kind or quality of material is given, an article as approved by the Engineer shall be provided.

B. Furnish the services of an experienced superintendent, who shall be constantly in charge of the work.

C. Equipment and materials shall be installed with the approval of the Engineer in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

D. Provide equipment in the mid-range of written performance documentation to allow for adjustment.

3.05 ACCESSIBILITY

A. Install the work with adequate clearances throughout the project, including being responsible for the sufficiency of the size of shafts, chases, double partitions, and suspended ceilings. Cooperate with other trades where work is in the same space. Such spaces and clearances shall be kept to the minimum size required.

B. Locate all equipment that must be serviced, operated, or maintained in fully accessible positions. Minor deviations from the Drawings may be made to allow for better accessibility and any change shall be approved by the Engineer.

C. The Mechanical Subcontractor shall provide the General Contractor the exact locations of access panels for each concealed valve, control damper, or other device requiring service. Access panels shall be provided and installed by the General Contractor and as specified in the other divisions of the Specifications. Submit locations of these panels to the General Contractor in sufficient time to be installed in the normal course of work.

3.06 CUTTING AND PATCHING

A. Provide drilling, coring, cutting, and patching necessary to install the work specified in this division. Patching shall match adjacent surfaces.

B. No structural members shall be cut without the approval of the Engineer and cutting shall be performed in a manner directed by the Engineer. Do not damage or endanger any portion of the project or work of the Owner or any other separate contractor by drilling, coring, cutting, patching, excavating, and backfilling.

C. Inform the General Contractor and other subcontractors affected of requirements for cutting and patching.

3.07 BOXES, SLEEVES, AND CHASES

Inform the General Contractor of requirements for boxes, sleeves, and chases. The General Contractor shall set boxes, sleeves, and chases. Furnish General Contractor with the boxes and sleeves and be responsible for informing the General Contractor of required location.

3.08 OPERATING INSTRUCTIONS

A. Upon completion of the work, furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of three (3) days of eight (8) hours each, or as otherwise specified. Give at least forty-eight (48) hours' notice to the Owner in advance of this period. During this period, instruct the Owner or his representative fully in the operation, adjustment, and maintenance of all equipment furnished. The training of the appropriate maintenance staff for each equipment type and/or system shall include, as a minimum, the following:

1. System/Equipment overview (what it is, what it does, and which other systems and/or equipment does it interface with).
2. Review of the available Operations and Maintenance (O&M) materials.
3. Review of the Record Drawings on the subject system/equipment.
4. Hands-on demonstration of all normal maintenance procedures, normal operating modes, and all emergency shutdown and startup procedures.

3.09 MECHANICAL EQUIPMENT MANUALS

A. Upon completion of the work and prior to acceptance of the mechanical work, prepare servicing manuals in accordance with industry-accepted standards describing the requirements of mechanical equipment provided under this division of the Specification.

B. As a minimum, include in the manuals:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Maintenance schedules.
3. Manufacturers' O&M instructions with parts list specific to the equipment installed, with extraneous matter removed or neatly marked out. Routine maintenance actions shall be clearly identified together with supplementary drawings and information where necessary to describe and itemize servicing.
4. Provide a table of contents with all contents listed in an orderly presentation.
5. Manufacturers' printed warranties.
6. Names, addresses, and phone numbers of the General Contractor, Mechanical Subcontractor(s), and all other related Subcontractors.
7. Names, addresses, and phone numbers of equipment suppliers.
8. Names, addresses, and phone numbers of at least two service agencies.
9. Controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field determined setpoints shall be permanently recorded on control drawings at control devices, or for digital control systems, in programming comments.
10. A complete narrative of how each system is intended to operate. A Sequence of Operation is not acceptable as a narrative for this requirement. Narrative shall include:
    a. A detailed explanation of the original design intent.
    b. The basis of design (how the design was selected to meet the design intent).
    c. A detailed explanation of how new equipment is to interface with existing equipment or systems (where applicable).
    d. Suggested set points.

C. Data in manuals shall be neat, clean copies. Drawings shall be accordion-folded. Manufacturers' advertising literature or catalogs will not be acceptable for O&M instruction.

D. Place data for the manual in hardcover three-ring loose-leaf notebooks. Label bound edge of notebooks with the name of the building, Owner, name of the project, year of completion and the words “Mechanical Equipment.” Label front of notebooks with the name of the Owner, name of the building, name of the project, Owner’s project number, date, General Contractor, Mechanical Subcontractor, Architect, and Mechanical Engineer.

E. Submit one copy of the data in a preliminary draft form to the Engineer for approval prior to preparing finished copies.

F. Provide two (2) copies of the finished manuals to the Engineer.

3.10 RECORD DRAWINGS

Provide Record Drawings in accordance with Section 1-05.5 of the WSDOT Division 1 Special Provisions.Record Drawings shall include as a minimum the location and performance data on each piece of equipment, general configuration of duct and pipe distribution system, including sizes, and the terminal air and water design flow rates of the actual installation. Record Drawings shall also incorporate any mechanical work that deviates from the Contract Drawings, including changes resulting from addenda, Requests for Information, and Change Orders. Neatly draft changes on clean “hard copy” drawings to show the work clearly in the actual locations as built.

3.11 CLEANING

Promptly remove waste material and rubbish caused by the work. At the Completion of the work, clean the dirt and debris from the mechanical installation, including equipment, piping, ductwork, and plumbing fixtures.

3.12 WARRANTY

A. All work, materials, and equipment to be free from defects. Correct all defects and failures occurring within one year from date of final acceptance in accordance with Section 1-05.10 of the WSDOT Division 1 Special Provisions.The warranty disregards shorter time limits by any manufacturer of equipment provided.

B. Make all necessary adjustments and corrections during first year of operation. The fact that the Engineer was present during any construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

3.13 GENERAL INSTALLATION

Install all valves with stems upright or horizontal, not inverted.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Pipe, duct, and equipment hangers and supports.

B. Seismic protection of piping and equipment.

1.02 REQUIRED SUBMITTAL DATA

Equipment bases and supports.

1.03 STANDARDS AND CODES

A. SMACNA publication "Seismic Restraint Manual – Guidelines for Mechanical Systems" for seismic protection of piping.

B. The International Building Code for seismic protection of equipment.

1.04 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 22 05 00 – Common Work Results for Plumbing apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. PIPE HANGERS AND SUPPORTS

1. Anvil, Erico, Grabler, Fee & Mason, Unistrut, Superstrut, or equal.

B. MATERIALS

1. All hangers, clamps, brackets, clips, supports, and hardware installed in submerged or wet well environments shall be 316 stainless steel. Hangers, clamps, backets, clips, supports, and hardware in all other areas shall be stainless steel or hot dipped galvanized.
2. All anchors, regardless of location shall be 316 stainless steel.

2.02 STRUCTURAL ATTACHMENTS

A. STEEL STRUCTURAL CLAMPS

1. Beam clamps, brackets, channel clamps, and bar joist clips shall be selected to suit structural system and meet loading recommendations of manufacturer.
2. Seismic retaining clips, Anvil Fig. 89X.

2.03 INTERMEDIATE ATTACHMENTS

A. HANGER RODS

1. Continuous threaded steel rod; do not use chain, wire, or perforated strap.
2. Maximum hanger rod loading as follows:

Rod Size, Diameter in Inches	Maximum Load, Pounds
⅜	610
½	1,130
⅝	1,810
¾	2,710
⅞	3,770
1	4,960

B. TRAPEZE PIPE RACKS: Fabricate from structural angles or channels or Unistrut channels to suit weight of piping to be supported. Size for a minimum safety factor of five (5).

C. HANGER STRAPS: Galvanized bar steel; ¾-inch wide by 18 gauge for 2½-inches and smaller pipe; ⅞-inch wide by 16 gauge for 3-inches to 4-inches pipe; 1⅛-inches wide by 12 gauge for 6-inch pipe size.

2.04 PIPE ATTACHMENTS

A. PIPE RINGS

1. Steel pipe and cast iron soil pipe: 2-inch and smaller, adjustable ring Anvil #69. 2½-inch and larger, adjustable clevis Anvil #260.
2. Copper Pipe: 2-inch and smaller, adjustable ring Anvil #CT-69. 2½-inch and larger, adjustable clevis Anvil #CT-65.
3. Finish: Copper plated where ring comes in contact with copper pipe; galvanized for contact with galvanized steel pipe; black for all other applications.
4. Application: Use only on piping systems where axial movement from thermal expansion is less than ½-inch.

5. For Hanger Straps: Elcen Figure 94 or Anvil Figure 97 with flattened-end bolt through cast iron socket; or hinged type, Modern Hanger Corporation No. 20, Elcen Figure 104, or Anvil Figure 108. Pipe rings shall be electrogalvanized, prime painted or cadmium-plated.

B. PIPE CLAMPS

1. Vertical piping: Unistrut P-1332 shelf bracket, Unistrut P-1100 channel, and Unistrut P-1100 series pipe clamps. Copper pipe clamps for copper pipe.
2. Horizontal racked piping: Unistrut P-1109 series or Unistrut P-2024C series clamps for Unistrut channel pipe racks.
3. Application: Use on piping systems without any thermal expansion.

PART 3 : EXECUTION

3.01 HANGER SPACING FOR PIPING

A. HORIZONTAL COPPER PIPE: Maximum hanger spacing and minimum hanger rod diameters as follows:

Pipe Size	Span	Rod Diameter
½-inch pipe	5-foot span	⅜-inch rod
1-inch pipe	6-foot span	⅜-inch rod
1¼ and 1½-inch	6-foot span	⅜-inch rod
2 and 2½-inch pipe	9-foot span	½-inch rod
3 and 4-inch pipe	10-foot span	½-inch rod
6-inch pipe	14-foot span	¾-inch rod
8-inch pipe	16-foot span	¾-inch rod

B. Provide additional hangers or supports at concentrated loads such as valves, to maintain alignment and prevent sagging.

C. Piping crossing over excavated and backfilled areas, provide precast concrete beam supported by the building structure and undisturbed earth.

3.02 INSTALLATION OF PIPE HANGERS AND SUPPORTS

A. Provide piping supports and hangers with a means of adjustment for leveling, grading of piping and cold spring movements.

B. Provide sufficient hanger rod lengths to limit rod displacement from thermal expansion to 4 degrees from vertical.

C. Size pipe rings and clamps to pass around the outside of the piping insulation. Provide Anvil Fig. 160 pipe covering protection saddles at pipe rings where pipe insulation does not include a vapor barrier. Provide Anvil Fig. 167 insulation protection shields at pipe rings where pipe insulation includes a vapor barrier. Provide rigid inserts as required to prevent crushing of insulation.

3.03 SEISMIC PROTECTION OF PIPING

A. SEISMIC RESTRAINTS

1. Provide seismic protection for all piping in accordance with the most current edition of the SMACNA publication “Seismic Restraint Manual – Guidelines for Mechanical Systems,” Hazard Level A.

3.04 SEISMIC PROTECTION OF EQUIPMENT

Provide seismic protection for all equipment in accordance with ASHRAE Handbook, current edition.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Pipe Insulation and heat tracing.

1.02 SUBMITTALS

A. In accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Descriptive literature or shop drawings for insulation and electric heat tape
2. Provide complete manufacturer's installation instructions.
3. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

Electric Heat Tape.

1.03 STANDARDS AND CODES

A. GENERAL

1. NFPA 90A and 90B, UL 181 (Class 1), and UL 723.
2. Washington State Energy Code Commercial Provisions, latest adopted version.

B. FOR ELASTOMERIC MATERIAL

1. ASTM C534

C. FOR FLAME SPREAD AND FUEL CONTRIBUTED AND SMOKE

1. UL Standard No. 723, NFPA Standard No. 255, and ASTM Standard E84.

D. RED LIST

1. Materials as defined by the Living Building Challenge Rating System known to have a hazardous effect on human health.

1.04 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 22 05 00 – Common Work Results for Plumbing apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCT

2.01 GENERAL

A. Materials shall be of the highest grade. Adhesives, sealers, vapor coatings, etc., shall be compatible with the materials to which they are applied, and shall not corrode, soften, or otherwise attack such material in either the wet or dry state. Scrap pieces of insulation shall not be used where a full section will fit. Glass fiber materials which become wet or damaged during installation shall be removed and replaced with new materials. Acceptability of a manufacturer is not to be taken as acceptability of his "usual" or "regular" accessory materials such as facings, adhesives, etc.

B. Unless specified otherwise, all facings, coatings, PVC covers, and other accessories shall have a fire hazard rating not to exceed 25 for Flame Spread and 50 for Fuel Contributed and Smoke Developed; ratings determined by UL 723, NFPA 255, or ASTM E84. UL label or listing, or satisfactory test results from the approved testing laboratory, shall be available to indicate that fire hazard ratings for materials do not exceed the above amounts.

C. Materials shall be formaldehyde free and free of Living Building Challenge Red List Materials.

D. Product used shall emit no volatile organic compounds (VOCs) when applied, and shall not contain phenol, formaldehyde, or acrylics.

E. Insulation shall comply with the latest adopted version of the Washington State Energy Code Commercial Provisions.

F. Pipe insulation shall be applied to all sanitary sewer piping and domestic cold-water piping that is exposed and above grade in the Engine Room. Insulation shall be continuous where insulated pipe passes though structures.

2.02 ACCEPTABLE MANUFACTURERS

A. Product name and numbers listed are Owens-Corning Fiberglas, Armstrong Cork Company, and Childers.

B. Other acceptable manufacturers are Manville, Certain-Teed, Knauf, or equal.

2.03 PIPING INSULATION MATERIALS

A. Provide insulation material as follows:

Service	Insulation Material	Insulation Cover
Domestic Cold Water Piping	Two-Piece Fiberglas ASJ/SSL-II	Fiberglas ASJ/SSL-II, or at contractor's option Armstrong ½-inch thick self-seal Armaflex 2000 on piping ½-inch thru 2-inch pipe size

Service	Insulation Material	Insulation Cover
Exposed Sanitary Sewer Piping	Pre-Molded Fiberglass with "K" value of 0.25 at 50° Fahrenheit	John Mansvill Micro-Lok with scrim foil jacket or accepted equal

2.04 PIPING INSULATION

A. All domestic cold water piping, including all piping installed in concealed spaces, shall be insulated per the following table, and in accordance with all requirements of the Washington State Plumbing Code, and shall be sealed vapor tight to prevent condensation from forming on the pipe or insulation.

B. Insulate all piping with the materials specified in the preceding table to the thicknesses required in the latest adopted version of the Washington State Energy Code Commercial Provisions, and in accordance with the following table, except:

1. Specified insulation that has a conductivity outside the range indicated in the following table shall be provided with the minimum thickness required in the "Alternative Insulation Types" portion of the Washington State Energy Code Commercial Provisions.

Design Operating Temp Range (°F)	Insulation Conductivity		Nominal Pipe Diameter (Inches)				
	Conductivity Range (BTU-in/ (h-ft2-°F)	Mean Rating Temp (°F)	Up to 1	1 to <1½	1½ to <4	4 to <8	>8
All Domestic Water and Service Hot Water Systems							
Below 105	0.22-0.28	75	0.5	0.5	1.0	1.0	1.0

C. Provide Type 316 stainless steel roll or cut and roll jacketing, elbows, and accessories for all exposed insulation on sanitary sewer pipe in accordance with ASTM C1767. Jacket shall have a minimum 3/16-inch thickness with a stucco embossed finish. Use pressed elbow covers as available. Jacketing for tees, valves, flanges, caps, etc. shall be factory or field-fabricated to fit closely around insulation. Use stainless steel banding. Sealants shall be used to seal around protrusions, insulation terminations, and jacketing slip joints. Jacketing shall be as manufactured by John Manville or accepted equal.

2.05 PIPE METAL JACKETING

A. Childers Strap-On aluminum jacket, 0.016-inch minimum thickness and ½-inch wide aluminum bands, 0.02-inch minimum thickness for pipe.

B. Childers aluminum jacket, 0.02-inch minimum thickness for pipefittings.

C. John Manville Type 316 Stainless Steel Jacket

2.06 RIGID INSERTS

Manville Thermo-12 pipe insulation, cork, or shaped wood.

2.07 INSULATION PROTECTION SHIELDS

Provide stainless steel insulation protection shields (top and bottom) at all pipe supports to protect insulation from being crushed. Type B3154 by Cooper Industries or accepted equal.

2.08 ELECTRIC HEAT TAPE

A. Raychem "XL-Trace" self-regulating UL listed system complete with heaters, components, and controls furnished to operate online voltages with transformers for the electrical characteristics indicated in the electrical portion of the drawings and/or specifications. Provide with ground fault interrupt protection.

B. Heater sized according to the following table. The required heater output rating is in watts per foot at 50°F. Heater selection based on 1-inch fiberglass insulation on metal piping.

	Minimum Ambient	Temperatures
Pipe Size	−10°F	−20°F
3-inch or less	5 watt	5 watt
4-inch	5 watt	8 watt
6-inch	8 watt	8 watt
8-inch	2 strips-5 watt	2 strips-8 watt
12-inch to 14-inch	2 strips-8 watt	2 strips-8 watt

C. Control consisting of a thermostatically controlled sensing bulb #AMC-F5 set at 40°F through an appropriate contractor.

D. Heating cable shall be UL approved, suitable for a Class 1 Division 2 hazardous environment.

E. The heat tracing system shall be supplied complete with power connection kits, splice kits, tees, end seals, installation tape, pipe straps and labels. Heating cable shall be attached to the pipe by means of fiberglass or aluminum tape. Installation and testing of the heat tracing system shall be in strict accordance with the manufacturer's instructions.

PART 3 : EXECUTION

3.01 PREPARATION

A. Install covering after piping, ductwork, heat tracing system, and equipment have been tested and approved.

B. Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application.

C. Ensure insulation is continuous through inside walls except at firewalls.

D. Deliver material to job site in original non-broken factory packaging, with manufacturer's labels.

E. Perform work at ambient and equivalent temperatures as recommended by the manufacturer.

F. Apply insulation to connections, joints, welds, flanges, or threaded joints after pipe tests are completed.

G. Apply insulation over flanged joints after piping has been brought up to operating temperature and flange bolts have been fully tightened.

H. Insulate flanges, unions, strainers, flexible connections, and expansion joints only on domestic cold-water systems.

I. Provide rigid inserts where piping supports pass around the outside of insulation with a vapor barrier. Repair damage to vapor barrier resulting from installation of the inserts by sealing with a vapor barrier pressure-sensitive tape.

J. Finish insulation neatly at hangers, supports and other protrusions.

K. Provide adequate support for insulation on vertical pipe to prevent slipping.

L. Insulate thermometer and pressure/temperature test wells over their exterior length. Insulate wells protruding above finish pipe or equipment insulation. Neatly taper insulation away from top of well.

M. Insulate pressure gauge lines up to first shutoff valve in gauge lines.

N. Cover piping, fittings, valves, and accessories in utility tunnels, located outdoors, and where indicated on the drawings with metal jacketing.

O. Do not insulate cold-water piping or rainwater leader buried under concrete slab on grade, or direct buried underground pipe outside the building.

P. Insulate soil and waste piping where noted on the drawings, where piping is installed in outside walls, and where subject to freezing.

Q. Seal butt joints of insulation with pressure sensitive vapor barrier tape. Seal exposed ends of insulation with Benjamin-Foster 30-36, and at 21-foot intervals on continuous runs of pipe. Use Armstrong #520 adhesive on Armaflex II and Armstrong 2000 products. Apply insulation with all sides and end joints butted tightly.

R. ELECTRIC HEAT TAPE

1. Apply the heater linearly on the pipe after piping has been successfully pressure tested. Secure the heater to piping with cable ties or fiberglass tape. Aluminum tape for plastic pipe. Make necessary connections.
2. Apply “electric traced” signs to the outside of the thermal insulation.
3. Tests:
    a. After installation and before and after installing the thermal insulation, subject heater to testing using a 1000 VDC megohmmeter. Minimum insulation resistance should be 20 to 1000 megaohms regardless of length.

END OF SECTION

SECTION 22 10 00
MECHANICAL GENERAL PROVISIONS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Provisions of this Section shall apply to all sections in Division 22 – Plumbing.

1.02 STANDARDS AND CODES

A. Meet requirements of local and state codes.

B. All electrical equipment and materials specified herein shall be approved by Underwriters Laboratories (UL) for the purpose for which they are used and shall bear the UL label. Labels from other electrical testing laboratories will be acceptable if approved by the local electrical inspection authority.

1.03 SUBMITTALS

A. In accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Descriptive literature or shop drawings for all equipment, plumbing fixtures, floor drains, heaters, etc.
2. Provide complete manufacturer's installation instructions.
3. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Exercise care in transporting and handling to avoid damage to material.

B. Store materials on the site so as to prevent damage or theft.

C. Keep materials clean, dry, and free from deleterious conditions. Do not allow materials to rust.

D. Do not store materials directly on the ground.

E. Repair or replace damaged material or equipment to the satisfaction of Owner.

F. Protect electrical equipment, controls, and insulation against moisture and water damage.

G. The Contractor shall be responsible for the equipment included in this Contract until it has been finally inspected, tested, and accepted in accordance with the requirements of these Specifications.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS

A. In accordance with applicable Section of Division 22 – Plumbing.

B. Pipe fittings, wiring, and supports shall be provided to produce complete, operable systems, with all elements properly interconnected as shown in schematic diagrams, or to provide specified operations.

C. If a specified dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

D. Equipment and material shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned, and adjusted for satisfactory operations; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair.

E. All equipment and material shall be designed for the service intended; shall be of rugged construction; of ample strength for all stresses which may occur during fabrication, transportation, erection, and during continuous or intermittent operation; shall be adequately stayed, braced, and anchored; and shall be installed in a neat and workmanlike manner.

F. Appearance and safety as well as utility shall be given consideration in the design of details.

G. Materials of construction shall be cathodically compatible.

H. Design, fabricate, and assemble equipment and systems with new materials and in accordance with acceptable modern engineering and shop practices.

I. Manufactured individual parts to standard sizes and gauges so repair parts can be installed in the field. Make like parts of duplicate units interchangeable.

2.02 ANCHOR BOLTS

A. Adequately sized for equipment loads and, in no case, less than the size recommended by the equipment manufacturer.

B. Use epoxy style anchors only. Wedge style anchors are not allowed.

C. EMBEDDED TYPE: When required by equipment manufacturer or field conditions.

D. CONCRETE ANCHOR TYPE: When allowed by Specifications or shown on Drawings.

E. Anchor bolts and anchor bolt assemblies shall be type 316 stainless steel.

2.03 COATING

A. MANUFACTURED EQUIPMENT

1. Protect all steel and iron surfaces by suitable coatings applied in shop.
2. Equipment surfaces which will be inaccessible after assembly shall be protection coated for the life of the equipment.
3. Finish smooth, thoroughly clean, and fill exposed surfaces as necessary to provide smooth, uniform base for coating.
4. Surfaces to be coated after installation shall receive 1 or more coats of primer to protect equipment until finish coats are applied.
5. Shop finish electric motors, speed reducers, starters, and other self-contained or enclosed components with oil-resistant enamel.
6. Apply rust preventative compound to all machined, polished, and non-ferrous surfaces that are not be painted.
7. Furnish at least 1 quart of finish coat material with equipment for field touchup.
8. Apply field coatings as required in accordance with Section 09 96 00 – Painting and Protective Coatings.

PART 3 : EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENT

A. In accordance with applicable Section of Division 22 – Plumbing.

B. Cooperate with all trades in furnishing material and information for correct location, in proper sequence, of all sleeves, inserts, foundations, wiring, etc.

C. Piping connections to equipment shall be made with unions or flanges to permit dismantling. Flanges and unions shall also be installed in the piping systems to permit disassembly consistent with good installation practice and as required for the removal of connected equipment from place of installation.

D. Belt drives, flexible couplings, and other exposed rotating or reciprocating parts shall be covered with approved safety covers. Covers shall be permanent type and easily removable.

E. Motor and bearings shall be covered with watertight and dustproof covers during construction period.

3.02 COORDINATION OF WORK

A. Plan all work so that it proceeds with a minimum of interference with other trades.

B. Openings required in the construction for the installation of the work under this division of these Specifications shall be coordinated with the work of all other trades.

C. Contractor shall pay for all extra cutting and patching made necessary by his failure to properly direct such work at the correct time.

3.03 INTERFERENCE

A. Contractor shall arrange the run of the piping in such a manner that it does not interfere with other piping and equipment and/or normal maintenance operations.

B. Pipe shall normally be run parallel to walls, ceiling, or floor.

3.04 INSULATING COUPLING

A. Furnish and install at all interconnections between piping systems of dissimilar materials and at all connections of piping systems to equipment where piping and equipment are of dissimilar materials.

B. Couplings shall be specifically designed for the purpose of electrically isolating pipelines from other piping systems or equipment.

3.05 WELDED INSTALLATION

A. Shop fabricated to maximum extent possible.

B. Use welders certified in accordance with the latest requirements of the American Welding Society “Standard Qualifications Procedures.”

C. Repair protective coating and linings to a condition equivalent to the factory-applied coating or lining.

D. Install coupling at ends of pipe to be welded to provide access for replacing protective lining.

3.06 PIPE OPENINGS

Openings in pipes shall be kept closed during the progress of the work.

3.07 VALVES AND VALVE DESIGNATION

A. Provide valves at each piece of equipment to provide for isolation of the equipment from its connected system.

B. Valves shall not be placed with stems below horizontal.

C. Provide chain wheel operators for all valves greater than 5 feet above finished grade.

3.08 ACCESS TO EQUIPMENT

A. All motors, valves, control devices, specialties, etc., shall be so located as to provide for easy access for operation, repair, and maintenance.

B. Concealed access doors shall be provided.

3.09 LUBRICATION

A. Provide lubrication for the operation of all equipment until acceptance.

B. Provide a chart listing each piece of equipment, the proper type of oil or grease required, and recommended frequency of lubrication.

C. Contractor shall be required to run in all bearings and, after they are run in, shall drain and flush bearings and refill with a new oil change.

D. Oil and lubrication fittings shall be located within reach from the operating surface.

END OF SECTION

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SECTION 22 10 05
PLUMBING PIPING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Pipe, pipe fittings, specialties, and connections for piping systems.

1. Sanitary sewer: Soil, waste, and vent.
2. Domestic water.
3. Flanges, unions, and couplings.
4. Pipe hangers and supports.
5. Valves.

1.02 STANDARDS AND CODES

A. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.

B. ASME B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. ASTM B32 – Standard Specification for Solder Metal.

D. ASTM B42 – Standard Specification for Seamless Copper Pipe, Standard Sizes.

E. ASTM B88 – Standard Specification for Seamless Copper Water Tube.

F. ASTM B88M – Standard Specification for Seamless Copper Water Tube (Metric).

G. ASTM B813 – Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.

H. ASTM B828 – Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

I. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

J. AWS A5.8M/A5.8 – Specification for Filler Metals for Brazing and Braze Welding.

K. MSS SP-58 – Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.

L. MSS SP-110 – Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

M. NSF 61 – Drinking Water System Components – Health Effects.

N. NSF 372 – Drinking Water System Components – Lead Content.

1.03 SUBMITTALS

A. See Section 22 05 00 “Common Work Results for Plumbing” for submittal procedures.

B. PRODUCT DATA: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS

POTABLE WATER SUPPLY SYSTEMS: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. COPPER PIPE: ASTM B42, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.

2.03 DOMESTIC WATER PIPING, ABOVE GRADE

A. COPPER TUBE: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, alloy Sn95 solder.

2.04 FLANGES, UNIONS, AND COUPLINGS

A. UNIONS FOR PIPE SIZES 3 INCHES AND UNDER

1. Ferrous Pipe: Class 150 malleable iron threaded unions.
2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. FLANGES FOR PIPE SIZE OVER 1 INCH

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. NO-HUB COUPLINGS

1. Gasket Material: Neoprene complying with ASTM C564.
2. Band Material: Stainless steel.
3. Eyelet Material: Stainless steel.
4. Manufacturers:
   a. ANACO-Husky
   b. Fernco
   c. Ideal-Tridon Group
   d. Mission Rubber Co.

2.05 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

2.06 BALL VALVES

A. MANUFACTURERS

1. Anvil International
2. Apollo Valves
3. Nibco, Inc

B. CONSTRUCTION, 4 INCHES AND SMALLER: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

C. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

END OF SECTION

SECTION 22 13 00
PIPE

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This Section specifies pipe materials and methods and shall be used in conjunction with Section 22 13 10 – HDPE Pipe and Fittings, Section 22 13 11 – Piping Systems, and other sections of Division 22 – Plumbing which specify piping components.

1.02 STANDARDS AND CODES

All pipe materials and methods shall conform to applicable requirements of documents of latest edition listed hereafter. In case of conflict between this Section and the listed documents, the requirements of this Section shall prevail.

ANSI A13.1	Piping and Piping Systems
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings, Class 150 (Flat Face Flange)
ANSI B16.9	Factory-Made Wrought Steel Butt-Welding Fittings
ASTM A47	Malleable Iron Castings
ASTM A74	Cast Iron Soil Pipe and Fittings
ASTM A120	Pipe, Steel, Pipe, Black and Hot-Dip Zinc-Coated (Galvanized), Welded and Seamless for Ordinary Uses
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature
ASTM A283	Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A312	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A351	Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
ASTM A536	Ductile Iron Castings
ASTM B32	Solder Metal
ASTM B43	Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B88	Seamless Copper Water Tube
ASTM D638	Standard Test Method for Tensile Properties of Plastics

ASTM D695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D1248	Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D1784	Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
ASTM D1785	Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2513	Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
ASTM D2467	Socket-type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	Solvent Cements for Polyvinyl Chlorine (PVC) Plastic Pipe and Fittings
ASTM D2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
ASTM D3034	Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D3261	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F1055	Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
ASTM F2164	Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
ANSI/AWWA C104/A21.4	Standard for Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
ANSI/AWWA C105/A21.5	Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
ANSI/AWWA C110/A21.10	Standard for Ductile Iron and Gray Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids

ANSI/AWWA C111/A21.11	Standard for Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
ANSI/AWWA C115/A21.15	Standard for Flanged Ductile Iron Pipe with Threaded Flanges
ANSI/AWWA C150/A21.50	Standard for Thickness Design of Ductile Pipe
ANSI/AWWA C151/A21.51	Standard for Ductile Iron Pipe, Centrifugally cast, in Metal Molds or Sand Lined Molds for Water and Other Liquids
AWWA C200	Standard for Steel Water Pipe, Six Inches and Larger
AWWA C206	Standard for Field Welding of Steel Water Pipe
AWWA C208	Standard Dimensions for Steel Water Pipe
AWWA C600	Standard for Installation of Ductile Iron Water Mains and Their Appurtenances
AWWA C601	Standard for Disinfecting Water Mains
CISPI 301	Standard for Cast Iron Soil Pipe
NFPA 54	National Fuel Gas Code
UPC	Uniform Plumbing Code (latest edition)

Standard Specifications – 2020 WSDOT Standard Specifications for Road, Bridge, and Municipal Construction.

1.03 SUBMITTALS

A. In accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Manufacturer's technical data for all piping, and documentation of conformance with appropriate standards and these specifications.
2. Detailed drawings of all interior piping requirements, prepared in conformance with the following:
    a. Plan drawings shall be prepared for all areas involving piping and equipment at a scale not less than 1-inch equals 1 foot. Plan drawings shall be prepared for all work areas that contain new piping. Sections shall be cut as required to clearly show piping in each of the plan drawings.
    b. Drawings shall be dimensioned to show the location of all new piping, pipe joints, pipe supports, pipe penetrations, valve end connections, and all other piping appurtenances.
    c. Drawings shall clearly show the methods of pipe joint connections, pipe support, pipe penetrations, valve end connections, and all other piping appurtenances.

d. Piping support structural requirements, calculations, manufacturers, spacing, and detailed drawings as required to establish that the proposed piping support and restraints meet the requirements of the specifications, drawings, and piping manufacturer.

e. Drawings shall show structural and mechanical components of the piping systems separately if required for clarity.

f. Drawings shall indicate field verified elevations/dimensions for existing facilities and connections, in addition to any dimensions identified on the Drawings.

3. Pressure Testing Plan.

4. Test Results.

1.04 QUALITY CONTROL

A. The Contractor shall utilize quality control procedures acceptable to the Engineer and the Owner for the following:

1. Inspection of pipe before installation.

2. Pipe unloading, storage, installation, and jointing.

B. Tests performed by the Contractor shall include, but not be limited to, the following:

1. Hydrostatic Pressure Test.

2. Air Pressure Test.

PART 2 : PRODUCTS

2.01 GENERAL

A. Materials required for all piping and connections shall be as specified herein and in Section 22 13 10 – HDPE Pipe and Fittings and Section 22 13 11 – Piping Systems. All pipe sizes shall be as shown on the Drawings.

B. All pipe sizes as shown on the Drawings and as specified herein are in reference to “nominal” diameter, unless otherwise indicated.

C. The piping systems shown on the Drawings indicate the appropriate horizontal and vertical configuration required. The Contractor shall determine the exact layout of piping, fittings, and joints necessary to fit actual field conditions.

D. Gasket type or material used shall be appropriate for each pipe system and service intended and shall be as specified in Section 22 13 10 – HDPE Pipe and Fittings and Section 22 13 11 – Piping Systems.

PART 3 : EXECUTION

3.01 GENERAL

A. LOCATION: The Contractor shall be responsible for checking and verifying all existing piping and appurtenances whether or not they are shown on the Drawings. The Contractor shall excavate and locate all existing pipes crossings, appurtenances, and points of connection. The Contractor shall check and verify or modify horizontal and vertical locations of each and every exposed piping run, with Engineer approval. The Contractor shall be responsible for the protection of all existing piping, appurtenances, and structures during construction and shall take care not to damage them or impair the operation in any way.

B. PIPING SIZES: Where the size of piping is not specified, the Contractor shall provide piping of the sizes required by UPC. Unless specified otherwise, small piping (less than 1 inch in diameter) required for service not described by UPC shall be ½ inch.

C. PIPE SUPPORTS: Piping hangers and structural attachments shall be as specified in Section 22 13 13 – Pipe Support Systems and shall be designed in conjunction with pipe to be supported and shall be installed in accordance with the approved submittal design and drawings. The Contractor shall install piping supports such that line and grade requirements are satisfied.

D. RESTRAINT: Piping under pressure shall be restrained at all bends, tees, pipe joints and couplings, unless otherwise indicated.

E. LINE AND GRADE DEVIATIONS

1. Buried, Bedded, and Encased Pipe. Variance from required line shall not exceed ½ inch. Variance from grade shall be in accordance with Section 7-08.3(2)B of the Standard Specifications.

2. Exposed Pipe. Variance from required line and grade shall not be greater than ¼ inch. All pipe shall be laid in straight runs with fittings as required for bends. Gravity flow pipe shall be laid at constant slope.

F. BURIED PIPE LAYING: Preparation of bedding and backfill shall be as specified in Section 31 23 33 – Trenching, Backfilling, and Compacting for Utilities and as indicated on the Drawings. Pipe shall be laid with uniform bearing under the full length of the barrel of the pipe.

G. PIPE PENETRATIONS: Pipe penetrations into structures shall be as shown on the Drawings.

H. ELECTRICAL ISOLATION: All connections between dissimilar metal pipe, such as copper or bronze to steel, coated to uncoated metallic piping, or piping with different types of coatings, shall be electrically isolated with an electrically insulating fitting. Fittings shall be unions, couplings, or flange sets for the service intended unless specified otherwise.

I. INSULATING FITTINGS: All metallic piping shall be isolated from all structures with appropriate insulating flanges, insulating flexible couplings, or insulating unions. New pipe shall be isolated from existing piping. Pipe at transitions from concrete encasement to soil shall be provided with insulating fittings.

Insulating fittings shall be placed at transitions between pipelines with dissimilar coatings.

3.02 TESTING

A. PIPE PRESSURE TESTING: Pipe shall be pressure tested to the test pressure indicated in Section 22 13 11 – Piping Systems. Hydrostatic pressure testing shall be in accordance with Section 7-09.3(23) of the WSDOT Standard Specifications and as specified herein. Low pressure air testing shall be in accordance with Section 7-17.3(2)F of the WSDOT Standard Specifications and as specified herein. Pressure testing shall be in accordance with the Uniform Plumbing Code and NFPA where indicated in Section 22 13 11 – Piping Systems.

1. The Contractor shall submit a Pressure Testing Plan to the Engineer for review and approval prior to testing for all pipe to be tested. The Plan shall include a narrative description of the test identifying all equipment used, temporary piping arrangements, test pressure and duration, testing schedule, testing water source location and backflow device, water disposal location and techniques, and what sections of pipe will be tested in what order.
2. TEST RESULTS: Submit Test Results for all pressure testing.
3. The Contractor is responsible for conveying the water used for testing. Water for testing will be supplied by the Contractor. Raw sewage shall not be used as the testing media.
4. Contractor shall perform all tests specified. Provide all test equipment including test pumps, gauges, volumetric measuring equipment, and other equipment required. Pressure gauges used shall be graduated in increments not greater than 5 psi and shall have a range of approximately twice test pressure. Use only gauges and instruments recently calibrated.
5. Completed installation shall comply with designated requirements. Provide replacement materials as may be required to accomplish this compliance.
6. Remove from systems, during testing, all equipment that would be damaged by test pressure. Replace removed equipment after testing. Systems may be tested in sections as work progresses; however, any previously tested portion shall become a part of any later test of composite system. Where new pipe connects to existing piping, the joint between the two pipes shall be tested. Correct leaks by remaking joints with new material; makeshift remedies will not be permitted. Test time will be accrued only while full test pressure is applied to system.
7. The Contractor shall be responsible for providing all temporary fittings, plugs, and thrust blocking for all testing at the specified pressure.
8. Perform all testing before backfilling, concealing, insulating, or painting.

9. Correction: Each section of pipeline which fails the pressure test and connection pipe and fittings that are observed to leak shall be removed and either properly reinstalled or replaced with new materials. Reinstalled and replaced pipeline sections shall be pressure tested after completion of backfilling.

10. Valves: Test valve bonnets for tightness. Test operate valves from closed-to-open-to-closed positions while valve is under piping pressure. Test automatic valves by actuating from fully open to fully closed position.

B. HANGERS AND SUPPORTS: With systems in normal operation, test hangers, supports, and rods to ensure they are plumb and support proper share of load. Additionally, support, as required, systems and equipment that sway, crawl, and vibrate.

C. OTHER MATERIALS AND EQUIPMENT: Test other materials and equipment as specified, as recommended by equipment manufacturer, or directed to assure they are complete, operable, and ready for use.

3.03 CLEANING

A. Clean equipment and materials. Remove foreign materials including dirt, grease, and other matter.

B. Clean by flushing interior of wastewater piping with water after pressure testing.

3.04 FLUSHING AND DISINFECTION OF WATER LINES

Flushing and disinfection of water lines shall be in accordance with Section 7-09.3(24) of the WSDOT Standard Specifications.

END OF SECTION

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SECTION 22 13 10
HDPE PIPE AND FITTINGS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

High Density Polyethylene (HDPE) pipe and fittings used for conveying wastewater from Pump Station 31 to the Pump Station 8 Force Main located in NE Clover Blossom Lane, as depicted in the Drawings.

1.02 SUBMITTALS

A. Submit in accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions.

B. Prior to shipping any material to the site, submit the following:

1. Manufacturer's product data including pipe, pipe accessories, and appurtenances. Provide manufacturers certificates for materials that meet or exceed these Specifications.
2. Detail drawings and product data showing pipe joint connections and couplings, to confirm compatibility of joining systems.

C. Prior to installation of any components, submit the following:

1. Pipe installer’s qualifications.
2. Certifications for fusion welder(s).
3. Plan(s) showing pipe installation sequence and schedule.

D. TESTING

1. Flushing/Pigging Plan.
2. Pressure Testing Plan.
3. Test Results.
4. Data logger joint information and joint checklist and data forms on each joint.

1.03 QUALITY ASSURANCE

A. REFERENCED STANDARDS: This Section incorporates by reference the latest revision of the following documents. It is part of this Section as specified and modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

1. ASTM International (ASTM) Standards:
    a. D638: Standard Test Method for Tensile Properties of Plastics.

b. D695: Standard Test Method for Compressive Properties of Rigid Plastics.

c. D1248: Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

d. D2837: Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.

e. D3261: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

f. D3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

g. F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

h. F714: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

i. F1055: Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

j. F2164: Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.

1.04 DELIVERY, STORAGE AND HANDLING

A. LABELING: The following information shall be continuously marked on the pipe and spaced at intervals not to exceed 5 feet:

1. Name and/or trademark of the pipe manufacturer.
2. Nominal pipe size.
3. Standard Dimensional Ratio (SDR)/Schedule.
4. Material Classification.
5. Manufacturing Standard Reference.
6. A production code from which the date and place of manufacture can be determined.

B. Transportation is the responsibility of the Contractor, who shall be liable for all damages prior to and during transportation to site.

C. During shipment and storage, the pipe shall be wrapped in relatively impermeable and opaque protective covers.

D. Inspect materials delivered to the site for damage. Unload and store with minimum of handling. Store the pipe and fittings in a flat, horizontal position. Do not sort materials directly on the ground. Keep inside of piping free of dirt and debris.

E. Handling, storage, and care on-site are the responsibility of the Contractor prior to, during and after installation. Handle pipes, fittings, and other accessories in a manner that ensures delivery to the point of installation in sound, undamaged condition. Do not drop pipe. Carry, do not drag, pipe to the point of installation.

1.05 QUALIFICATIONS

A. The pipe installer shall be qualified by experience in installation of HDPE pipe.

B. Joining pipe by butt-fusion welding shall be conducted according to manufacturer's recommendation by a person certified as capable of conducting butt-fusion techniques by the pipe manufacturer or manufacturer's authorized representative.

C. Contractors are considered qualified by installing a minimum combined total of 15,000 feet of HDPE pipe using thermal fusion joining on at least 3 separate projects.

PART 2 : PRODUCTS

2.01 PIPING SYSTEMS

A. HDPE pipe and/or fittings include:

Piping Description	Nominal Diameter	DR	Pressure Rating	ASTM D3350 Cell Classification
Force Main	See Drawings, Iron Pipe Size (IPS)	11	200 psi	445474

2.02 MATERIAL

A. HDPE pipe and fittings shall be extruded from PE 4710, high-density polyethylene compound conforming to ASTM D3350 for a PE 4710 material with a cell classification as shown in the table above or better. This material shall have a minimum long-term hydrostatic strength of 1600 psi when tested and analyzed by ASTM D2837.

B. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by pre-compounding in a concentration of not less than 2 percent.

C. The manufacturer's resin used to manufacture the pipe and fittings for this project shall be listed with the Plastic Pipe Institute TR-4 by company name and material designation as meeting the standard requirements for PE 4710 material.

D. HDPE products shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specifications from the same raw material supplier.

2.03 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. HDPE pipe meeting the requirements of this Section shall be used for all the outfall piping.

B. Pipe and fittings shall be of the nominal diameter shown on the Drawings. All pipe sizes shall conform to ASTM F714.

C. The maximum allowable hoop stress shall be 1000 psi at 140 degrees F.

D. The polyethylene pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. Any pipe with nicks, scrapes, or gouges deeper than 10 percent of the nominal wall thickness shall be rejected. The pipe shall be uniform in color, opacity, density, and other physical properties.

E. Joints and pipe connections shall be thermal butt-fusion. No mechanical couplings shall be used unless shown on the Drawings or approved by the Engineer.

2.04 HIGH DENSITY POLYETHYLENE (HDPE) FITTINGS

A. Molded or fabricated from HDPE pipe shall have the same or numerically smaller SDR than pipe connecting to the fitting. HDPE fittings shall be molded, for sizes 8-inch and smaller, if manufactured as a standard item. All other HDPE fittings shall be fabricated from HDPE pipe by means of thermal butt-fusion unless otherwise noted.

B. All molded HDPE fittings shall have the same or higher pressure rating as the pipe when installed in accordance with the latest technical specifications. All fabricated HDPE fittings shall have the same or higher pressure rating as the adjoining pipe when installed in accordance with the manufacturer's recommendations.

2.05 PIPE CONNECTIONS

Joints and pipe connections shall be thermal butt-fusion. No mechanical couplings shall be used unless approved by the Engineer or shown on the Drawings.

2.06 FLANGE ADAPTERS

Flange adapters shall be a complete one-piece, polyethylene molded adapter provided with a flange backup ring. Flange backup rings shall be 304 stainless steel with 150-pound, ANSI B16.5 standard dimensions unless specified otherwise. Flanged connections shall have the same or greater pressure rating as the pipe. All fasteners shall be 316 stainless steel and shall be assembled with anti-seize compound as recommended by the manufacturer. Gaskets shall be installed at all flanged connections.

2.07 GASKETS

A. Gaskets shall be required between HDPE flanged fittings and ductile or cast flanged fittings on appurtenances.

B. Gaskets shall be full face, flat ring, 1/8-inch material. Gaskets for wastewater service shall be Grade “M” halogenated butyl and conform to ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. Gaskets are not required for HDPE to HDPE flanged connections.

2.08 HARDWARE

Bolts, nuts, washers, and miscellaneous hardware shall be 316 stainless steel unless noted otherwise on the Drawings or in these Specifications. All hardware shall be assembled with anti-seize compound as recommended by the manufacturer.

2.09 ELECTROFUSION FITTINGS

A. Electrofusion couplers and branch saddles shall be used as shown on Drawings or if approved by the Engineer for situations where welding machine access is difficult or impossible.

B. Electrofusion couplers and branch saddles shall be constructed from injection-molded polyethylene with embedded heating or exposed wire technologies.

C. Connections shall retain full pressure rating of the host pipe once installed.

D. Electrofusion couplers and branch saddles shall be manufactured in accordance with ASTM F1055.

2.10 TRANSITION FITTINGS

A. Transition fittings, as shown on the Drawings, shall be used to connect existing pressure sewer laterals to the new 1-1/4” pressure service laterals (HDPE, SDR 11).

B. Transition fittings shall be factory fabricated fittings with HDPE pipe complying with ASTM D2513, SDR 11 and pipe material to match connecting pipe.

C. Transition fittings shall have 316 stainless steel threads.

D. Acceptable product includes IntegriFuse fittings (Integrity Fusion Products, Inc.) or approved equal.

PART 3 : EXECUTION

3.01 GENERAL

A. Install HDPE pipe and fittings at the locations, lines and grades shown on the Drawings. All HDPE pipe and fittings shall be installed in accordance with these Specifications and manufacturer’s recommendations.

B. Materials and Work which fail to meet the requirements of these Specifications shall be removed and disposed of at the Contractor's expense.

3.02 ALLOWANCE FOR THERMAL EXPANSION/CONTRACTION

A. PE 4710 material has a coefficient of thermal expansion of 8×10^{-5} in/in/deg F; Contractor to verify recommended coefficient of thermal expansion with pipe manufacturer.

B. Determine installation length of pipe based on site temperature and conditions. Contractor to install piping as shown on the Drawings and shall provide Engineer with any calculations for installation lengths per the following constraints:

1. Buried HDPE pipe shall be installed such that contraction between fittings/anchor points caused by temperatures dropping to 50 degrees F will produce the theoretical length of pipe between two points as shown on the Drawings while neglecting frictional forces.

3.03 PLACEMENT AND HANDLING

A. Handle all materials in such a manner as to ensure it is not damaged in any way.

B. Pipe shall be marked with the manufacturer's name, product identification, lot number, roll number, and roll dimensions.

C. The Engineer will examine the piping over the entire surface to ensure that no potentially harmful foreign objects are present. Any foreign objects so encountered shall be removed by the Contractor, or material shall be replaced.

3.04 CONFORMANCE TESTING

A. Samples of materials delivered to site may be collected for testing to verify conformance with properties in Part 2 of this Specification, at Engineer's discretion.

B. Samples, if required, will be obtained by the Engineer. All testing performed will be paid for by the Contractor.

3.05 PIPE JOINING

A. All joints shall be butt fused except for those indicated per the drawings. Butt fused joints shall have a joint weld strength equal to or greater than the tensile strength of the pipe itself. Flange adapters butt fused to the pipe shall be provided where indicated on the Drawings. No other types of joints or joint restraint devices will be allowed unless specifically shown on the Drawings or specified herein.

B. FLANGES

1. Bolts on flanges shall be tightened in a pattern sequence to the torque value recommended by the pipe and/or flange adapter manufacturer. A torque wrench shall be used to tighten all bolts and nuts. Bolts shall be retightened twice thereafter as follows:

a. One (1) to two (2) hours initial tightening and

b. Four (4) to six (6) hours after the initial tightening.

2. Flanges shall be marked with an indelible marker to indicate the number and time of each tightening.

C. FIELD FUSION

1. Fusing/joining pipe in the trench will not be allowed except for electrofusion of pipe as indicated on the Drawings. A tent/shelter that is specifically made for field fusion operations shall be set up over the joining operation at all times to minimize contamination and heat loss, as well as protect the operation during inclement weather. A suitable base board or ground sheet shall be set underneath the tent/shelter.

2. All connections shall be clean, dry, and free of detrimental surface defects before the connection is made. General dust and light soil may be removed by wiping the surfaces with clean, untreated, dry, lint-free, non-synthetic cloths. Heavier soil shall be washed or scrubbed off with soap and water solution, followed by a thorough rinsing with clean, clear water, and drying with clean, untreated, dry, lint-free, non-synthetic cloths. Chemical solvents are not to be used as they may leave a residue or be incompatible with HDPE.

3. Use handsaws and chain saws for cutting pipe. Chain saws shall be used without chain lubrication because of the potential for chain oil contamination.

4. The following procedures and requirements for joining/fusion of pipe are based on PPI's, Performance Pipe and WL Plastics pipe joining procedures and requirements. The butt fusion equipment and pipe manufacturer's more detailed instructions shall be used and followed. The stricter procedures and requirements shall be used and followed. Pipe manufacture shall provide a letter to Engineer of any differences of concern between these specifications and the pipe manufacturer's recommended procedures or requirements. Deviations to these specifications will be subject to the approval of the Engineer.

D. FUSION MACHINE PREPARATION

1. Wash the heater plate when cold before every welding session. Never use chemicals, metal, or abrasive implements to clean heating tool. Burned or charred material shall be removed in accordance with the equipment manufacturer's written instructions.

2. Using the equipment manufacturer's instructions, calculate and verify that the fusion machine hydraulic fusion joining pressure gauge setting is such that it is within the recommended interface pressure range.

3. Verify the heating tool is at and maintaining correct temperature. Monitor the heating tool surface with a calibrated pyrometer or an infrared temperature gauge to ensure proper temperature (heating tool thermometers will typically be higher than surface temperature). Verify that all points on the both heating tool surfaces where the surfaces will contact the pipe are within the recommended range.

E. FUSION EQUIPMENT: Pipe shall be properly supported on either side of the secure and support clamps: Properly align and secure the components in the butt equipment such that the pipes are aligned straight to each other at the fusion joint.

F. FACE: Face ends of pipe to establish smooth, clean parallel mating surfaces. Remove shavings with a clean, untreated, dry, lint free, non-synthetic cloth. Do not touch the component ends with hands after facing.

G. ALIGN: Bring the component ends together, check alignment, and check for slippage. Look for complete contact all around both ends with no detectable gaps.

H. MELT: Prior to pipe joining, heating tool surfaces must be clean, and heating tool surfaces must be up to the specified minimum recommended temperature (400°F), but not above the maximum recommended temperature (450°F). Optimum temperature is 425°F. Immediately after heating tool removal, quickly inspect (within 3 seconds) component ends for proper melt surfaces. They should appear flat, smooth, and be completely melted. Unacceptable melt is any combination of a concave (cupped), bubbly or pock-marked sandpaper like melt surface, or un-melted areas or melted material sticking to heating tool surface. Do not continue with making the joint if these conditions are observed as low strength joints result from improper melt surfaces. Allow melted ends to cool and remake the joint from the beginning.

I. JOIN

1. If acceptable melt is observed, immediately bring component ends together to ensure full contact.
2. Apply and hold joining force against the melted ends until the joint cools and solidifies. Observe the melt bead roll as the component ends are joined and the joining force is applied. The correct joining force will form a double bead that is rolled over to the surface on both ends. When the proper melt bead size of ¼ inch is formed, quickly and smoothly separate the ends, and remove the heating tool.
3. The joint must be kept under pressure until the joint has cooled sufficiently. While maintaining pressure, allow joint to cool under ambient conditions. Do not use forced air, water, or wet cloths to expedite cooling of the joint. Proper cooling times (under pressure) are dependent on pipe diameter, wall thickness, heater plate temperature and environmental conditions. Estimated cooling time as determined by the pipe manufacturer shall be adhered to at all times to ensure joint integrity. The pipe manufacturer's cooling times are estimates, however, and should therefore be considered as only a guideline. Adjustment to these times will likely be needed. A pyrometer shall be used to check the bead temperature. If the temperature is about the same as that of the pipe, the joint has cooled enough for gentle handling (i.e., removal of the joint/ pipe from the machine to start another joint). Additional time (30 minutes or more) is required for the joint to cool completely through, and until such additional time has elapsed, the pipe shall not be subject to rough handling or bending.

J. INTERIOR BEAD REMOVAL: Remove Interior Bead to create a smooth interior pipe surface at each joint.

K. INSPECT

1. On both sides, the double bead should be rolled over to the surface and be uniformly rounded and consistent in size and shape all around the joint. The combined width of the beads should be 2 to 2-1/2 times the height above the surface. The V-groove between the beads should not be deeper than half the bead height above the component OD surface. Use a bead gauge to check that bead width conforms to specifications. Enter information on joint checklist and data form. Number/code the joint using an indelible marker. Print out data from data logger/controller and verify compliance. Complete joint checklist and data form.
2. The Engineer will periodically check and monitor the joint/fusion process but will not observe all joints that are made. Joints that are made on any given day will be reviewed, approved, or rejected by the Owner's Representative that same day or the next day. Review of joints is subject to the Owner's Representative being provided with the data logger joint information and joint checklist and data forms on each joint and sufficient time to review the information prior to making a visual inspection of the joints. Pipe/joints shall be elevated and placed such that Owner's Representative can easily and readily review the entire joint. Under no circumstances shall pipe be installed without the Owner's Representative's review of the joints. Pipe that is installed without such review may be required to be removed or exposed for inspection.

L. REJECTED JOINTS

1. The following will be the basis and grounds for rejecting joints. Joints that are rejected will be cut out and remade from the beginning.
    a. Beads not rolled over to the surface.
    b. Flat beads.
    c. Non-uniform or irregular bead size or shape.
    d. Bead widths less than specified minimum.
    e. V-grooves deeper than specified.
    f. Misaligned joints (greater than 10 percent wall offset).
    g. Differences in trial data logger trace that indicate poor quality fusion.

3.06 MECHANICAL CONNECTIONS

A. Mechanical connections of the polyethylene pipe to auxiliary equipment, such as valves and other piping systems, shall be through flanged connections that shall consist of the following:

1. A polyethylene molded flange adapter shall be thermally butt-fused to the ends of the pipe.

2. Backup rings, as specified in this Section, shall be used behind the flange adapter.

3. Fasteners shall be of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer's standard. The Contractor shall re-torque the nuts after 4 hours.

B. ASSEMBLY: Prior to connecting flanged pipe, the faces of the flanges shall be thoroughly cleaned of all oil, grease, and foreign material. The gaskets shall be thoroughly cleaned and checked for proper fit. Care shall be taken to ensure proper seating of the flange gasket. All bolted connections shall be tightened with a torque wrench and bolts shall be tightened to the torque specified by the manufacturer of the HDPE flanges and/or backing rings and/or gaskets. Follow the manufacturer's specified bolt-tightening sequence. Bolts may be pre-tightened using conventional wrenches and/or air tools as long as the pre-tightening torque does not exceed approximately 50 percent of the final torque and the bolt-tightening sequence is followed. Do not attempt to flange up a pipeline that is too short by drawing the bolts together. If joints leak when the hydrostatic pressure test is applied, the gaskets shall be removed and reset and bolts re-tightened.

3.07 ELECTROFUSION FITTINGS

Electrofusion fittings shall be installed in strict conformance with manufacturer's instructions. All required equipment, manufacturer-recommended regulator and generator shall be provided by the Contractor. Workmen shall be trained in the installation, and the welding procedure shall be reviewed with the Engineer prior to start of work.

3.08 CLEANING

A. Prior to testing, pipelines shall be cleaned to remove shavings, welding slag, dirt, construction debris, and other foreign material.

B. Clean HDPE force main by inserting and flushing cleaning pigs through the force main until the flushing water is clean and accepted by the Owner. Owner shall witness the cleaning operations.

C. If HDPE force main is temporarily used during construction to convey wastewater flow, the force main shall be pigged a second time prior to operation of the new pump station.

D. Perform flushing/pigging of pipelines in accordance with the manufacturer's recommendations. The Contractor shall submit valid certification of training for at least one person to be onsite during flushing issued by an established pig manufacturer. Pigs shall be selected and installed as recommended by the manufacturer based on the pipe material, configuration, and pressure rating of the force main. Pigs shall be provided by Girard Industries, or accepted equal.

E. The Contractor shall submit a Flushing/Pigging Plan to the Engineer for review and approval prior to cleaning. The Plan shall include at a narrative description of the flushing/pigging operation identifying all equipment used, certification of training, temporary piping arrangements, flushing pressures, testing water source location and backflow device, water disposal location and techniques, cleaning schedule, and what sections of pipe will be flushed/pigged in what order.

F. Hoses, temporary piping and valving, ditches, etc., as required to conduct pigging operations and dispose of flushing water without damage to adjacent properties is the Contractor's responsibility and to be provided at no additional cost to Owner.

G. Submit results/completion of flushing/pigging.

3.09 PRESSURE TESTING

Pressure testing and acceptance shall be conducted in accordance with ASTM F2164. The HDPE shall be filled with water, raised to the test pressure specified in Section 22 13 11 – Piping Systems and allowed to stabilize. The Contractor shall submit a Pressure Testing Plan and Test Results in accordance with Section 22 13 00 – Pipe.

END OF SECTION

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SECTION 22 13 11
PIPING SYSTEMS

PART 1 : GENERAL

1.01 DESCRIPTION

This Section describes the requirements for each of the piping systems included in the work. Each of the forms at the end of the Section describes a separate piping system, including the following: service; piping color; pipe identification legend; piping system abbreviation; gaskets; testing requirements; service pressure; service temperature; and pipe, fitting, and valve specifications for each pipe size required.

1.02 STANDARDS AND CODES

A. As indicated in Section 22 13 00 – Pipe.

B. Standard Specifications - 2020 WSDOT Standard Specifications for Road, Bridge, and Municipal Construction.

1.03 GENERAL REQUIREMENTS

All pipe and fittings shall be in accordance with the requirements of Section 22 13 00 – Pipe, and as specified herein. All piping appurtenances shall be in accordance with the requirements of Section 22 13 19 – Pipe Appurtenances. All valves shall be in accordance with the requirements of Section 22 13 15 – Valves Basic Requirements and individual valve sections.

PART 2 : PRODUCTS

2.01 PIPING SYSTEMS

Each piping system shall be composed of the pipe, piping appurtenances, and/or valves specified by the forms included hereinafter. The forms are included by the abbreviations shown on the Drawings and as follows:

System Abbreviation	System
D	Drain
SD	Storm Sewer
SS	Sanitary Sewer (gravity)
SSFM	Sanitary Sewer Force Main (pressure)
V	Vent
W	Potable Water

PIPING SYSTEM SPECIFICATIONS

System Drain	**Background Color**	**Legend** D	**Abbreviations** D
Gasket: As specified	**Test Medium:** ☐Air ☒ Water		**Duration:** * Min

Pressure — PSIG			**Temperature — °F**	
Work: *	Max: *	Test: *	Normal: 65	Max: 85

Pipe Size	Exposure	Item	Description
All	BURIED EXPOSED	Pipe	As indicated on the Drawings. Cast iron soil pipe (CISP): ASTM A74, service weight. PVC: Schedule 80, Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Threaded Nipples: Schedule 80 PVC. Perforated per AASHTO M278 where noted "Perforated" on the Drawings.
		Lining	None.
		Coating	None.
		Fittings	CISP: ASTM A74. PVC: Schedule 80 as specified under Pipe above, ASTM D2466 and ASTM D2467 for socket-weld type and ASTM D2464 for threaded type.
		Joints	CISP: Hub and spigot per ASTM A74. Service weight. PVC: Solvent socket-weld, except where connection to valves and equipment may require future disassembly.
		Couplings	As indicated on the Drawings and specified in Section 22 13 19 – Pipe Appurtenances.
		Gaskets Solvent Cement	CISP: Compression type, molded one-piece gasket made of an elastomer per ASTM C564. PVC: As recommended by the pipe and fitting manufacturer conforming to ASTM D2564.
		Joint Lubricant	CISP: Manufacturer's standard. PVC: Teflon tape for threaded joints.

Remarks: *in accordance with the Uniform Plumbing Code.

PIPING SYSTEM SPECIFICATIONS

System Storm Drain	**Background Color**	**Legend** SD	**Abbreviations** SD
Gasket: Rubber	**Test Medium:** ☒ Air ☐ Water		**Duration:** * Min

Pressure — PSIG			**Temperature — °F**	
Work: *	Max: *	Test: *	Normal: 65	Max: 85

Pipe Size	**Exposure**	**Item**	**Description**
All	BURIED EXPOSED	Pipe	ASTM D3034 SDR 35
		Lining	Not Applicable
		Coating	Not Applicable
		Fittings	ASTM D3034 SDR 35
		Joints	Elastomeric gaskets per ASTM F477
		Couplings	As indicated on the Drawings and specified in Section 22 13 19 – Pipe Appurtenances.
		Gaskets	Manufacturer's standard.
		Joint Lubricant	Manufacturer's standard.

Remarks: *in accordance with Section 7-04 of the WSDOT Standard Specifications.

PIPING SYSTEM SPECIFICATIONS

System	**Background Color**	**Legend**	**Abbreviations**
Sanitary Sewer (gravity)	—	SS	SS
Gasket: Rubber	**Test Medium:** ☒ Air ☐ Water		**Duration:** * Min

Pressure — PSIG			**Temperature — °F**	
Work: *	Max: *	Test: *	Normal: 65	Max: 85

Pipe Size	**Exposure**	**Item**	**Description**
8” and larger	BURIED	Pipe	PVC: Conforming to AWWA C900 or C905, pressure Class 150.
		Joints	Bell-and-spigot, push-on type.
		Fittings	One-piece injection molded from a PVC compound conforming to ASTM 1784. Fittings shall be Class 150 conforming to DR 18. Fittings shall be gasket-end conforming to ASTM D3139 with gaskets conforming to F477. Cement-lined ductile iron fittings with mechanical or push-on joints conforming to AWWA C153 or C110 may be approved as an alternative when PVC pressure fittings of the required sizes are not available.
		Gaskets	Manufacturer’s standard.
		Joint Lubricant	Manufacturer’s standard.
6” and smaller	BURIED	Pipe	PVC: Conforming to ASTM D3034 SDR 35.
		Joints	PVC: Conforming to ASTM D3212.
		Fittings	PVC: Injection molded, factory welded, or factory solvent cemented.
		Gaskets	Manufacturer’s standard.
		Joint Lubricant	Manufacturer’s standard.
Remarks:	*in accordance with Section 7-17.3(2)F of the WSDOT Standard Specifications.		

PIPING SYSTEM SPECIFICATIONS

System	**Background Color**	**Legend**	**Abbreviations**
Sanitary Sewer Force Main (pressure)	Green	SSFM	SSFM
Gasket: As specified	**Test Medium:** ☐ Air ☒ Water		**Duration:** * Min

Pressure — PSIG			**Temperature — °F**	
Work: 40-50	Max: 60	Test: 120	Normal: 65	Max: 85

Pipe Size	**Exposure**	**Item**	**Description**
All	BURIED, as indicated on the drawings	Pipe	Ductile iron pipe, pressure class 350, in accordance AWWA C151/A21.51.
		Lining	Protecto 401 Ceramic Epoxy Lining, or accepted equal. Apply in accordance with manufacturer's instructions.
		Coating	Asphaltic (bituminous) per AWWA C151/A21.51.
		Fittings	As indicated on the Drawings. Lined and coated same as pipe. Mechanical Joint: Mechanical joint fittings conforming to AWWA C110/A21.10 with mechanical joint restraint assemblies Ebba Iron Series 1100 Megalug, or accepted equal. Joint restraint assemblies shall be rated for 350 psi working pressure.
		Joints	Proprietary restrained push-on type. American Cast Iron Pipe Company – Flex-Ring; U.S. Pipe – TR Flex; or accepted equal.
		Couplings	As indicated on the Drawings and specified in Section 22 13 19 – Pipe Appurtenances.
		Bolting	Mechanical and Push-on Joints: Manufacturer's standard.
		Gaskets	Push-on and Mechanical: Rubber conforming to AWWA C111/A21.11. Gasket pressure rating to equal or exceed the system hydrostatic test pressure.
		Joint Lubricant	Manufacturer's standard.
All	EXPOSED	Pipe	Ductile iron pipe, pressure class 350, in accordance AWWA C151/A21.51.
		Lining	Protecto 401 Ceramic Epoxy Lining, or accepted equal. Apply in accordance with manufacturer's instructions.
		Coating	Provide ductile iron pipe and fittings bare (without exterior asphaltic coating) where sandblasting and painting of the pipe and fittings is specified in Section 09 96 00 – Painting and Protective Coatings.

PIPING SYSTEM SPECIFICATIONS

System	**Background Color**	**Legend**	**Abbreviations**
Sanitary Sewer Force Main (pressure)	Green	SSFM	SSFM
Gasket: As specified	**Test Medium:** ☐ Air ☒ Water		**Duration:** * Min

Pressure — PSIG			**Temperature — °F**	
Work: 40-50	Max: 60	Test: 120	Normal: 65	Max: 85

Pipe Size	**Exposure**	**Item**	**Description**
All CONT.	EXPOSED CONT.	Fittings	As indicated on the Drawings. Lined and coated same as pipe. Flanged: AWWA C110/A21.10 and ANSI B16.1, ductile iron, faced and drilled, 125-pound flat face. Gray cast iron will not be allowed. Grooved End: AWWA C606 and C110/A21.10, ductile iron, 250 psi minimum working pressure. Victaulic, or accepted equal.
		Joints	As indicated on the Drawings, or same as specified for fittings. Grooved End: Rigid type radius cut conforming to AWWA C606, 250 psi minimum working pressure.
		Couplings	As indicated on the Drawings and specified in Section 22 13 19 – Pipe Appurtenances.
		Bolting	125-Pound Flat Faced Flange ANSI Template: ASTM A193/A193M Type 316 stainless steel Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts. Washers shall be same material as nut. Nuts shall be Heavy hex-head, Type 2H. Grooved End Joints: Type 316 stainless steel Grade B8M, Class 2.
		Gaskets	Flanged: 1/8-inch thick, red rubber (SBR), hardness 80 (Shore A) rated for 200 degrees F, conforming to ANSI B16.21, AWWA C207, and ASTM D1330, Grades 1 and 2. Full face for 125-pound flat-faced flanges. Grooved End Joints: Halogenated butyl conforming to ASTM D2000 and AWWA C606. Gasket pressure rating to equal or exceed the system hydrostatic test pressure.
		Joint Lubricant	Manufacturer's standard.
All	BURIED – PS 31 Force Main, as indicated on the Drawings	Pipe	Per Section 22 13 10 – HDPE Pipe and Fittings.
		Lining	Not Applicable
		Coating	Not Applicable

PIPING SYSTEM SPECIFICATIONS

System	**Background Color**	**Legend**	**Abbreviations**
Sanitary Sewer Force Main (pressure)	Green	SSFM	SSFM

Gasket: As specified	**Test Medium:** ☐ Air ☒ Water	**Duration:** * Min

Pressure — PSIG			**Temperature — °F**	
Work: 40-50	Max: 60	Test: 120	Normal: 65	Max: 85

Pipe Size	**Exposure**	**Item**	**Description**
		Fittings	Per Section 22 13 10 – HDPE Pipe and Fittings.
		Joints	Per Section 22 13 10 – HDPE Pipe and Fittings.
		Couplings	Per Section 22 13 10 – HDPE Pipe and Fittings.
		Bolting	Not Applicable
		Gaskets	Not Applicable
		Joint Lubricant	Not Applicable
Remarks:	*in accordance with Section 7-09.3(23) of the Standard Specifications.		

PIPING SYSTEM SPECIFICATIONS

System Vent	**Background Color** —	**Legend** V	**Abbreviations** V
Gasket: —	**Test Medium:** ☒ Air ☐ Water		**Duration:** * Min

Pressure — PSIG			**Temperature — °F**	
Work: *	Max: *	Test: *	Normal: 70	Max: 95

Pipe Size	**Exposure**	**Item**	**Description**
4”	BURIED	Pipe	PVC: Schedule 80, Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Threaded Nipples: Schedule 80 PVC.
		Lining	None.
		Coating	None.
		Fittings	PVC: Schedule 80 as specified under Pipe above, ASTM D2466 and ASTM D2467 for socket-weld type and ASTM D2464 for threaded type.
		Joints	PVC: Solvent socket-weld, except where connection to valves and equipment may require future disassembly.
		Solvent Cement	PVC: As recommended by the pipe and fitting manufacturer conforming to ASTM D2564.
		Joint Lubricant	Teflon tape for threaded joints.
6”	EXPOSED	Pipe	Stainless Steel (SST): Schedule 40, Type 316L per ASTM A312.
		Fittings	SST: Butt-weld.
		Joints	SST: Butt-weld.
		Lining	None.
		Coating	None.

Remarks: *in accordance with the Section 7-17.3(2)F of the Standard Specifications and the Uniform Plumbing Code.

PIPING SYSTEM SPECIFICATIONS

System	**Background Color**	**Legend**	**Abbreviations**
Potable Water	Blue (Potable)	W	W
Gasket: —	**Test Medium:** ☐ Air ☒ Water		**Duration:** 120 Min

Pressure — PSIG			**Temperature — °F**	
Work: 60	Max: 90	Test: 150	Normal: 50	Max: 70

Pipe Size	**Exposure**	**Item**	**Description**
All	EXPOSED	Pipe	Stainless Steel (SST): Schedule 80, Type 316L per ASTM A312.
		Fittings	SST: Threaded, Class 150 pound per ASTM A351, Type to match Pipe specified.
		Joints	SST: Threaded to match Pipe specified.
		Lining	None.
		Coating	None.
All	BURIED	Pipe and Fittings	Polyethylene in accordance with Section 9-30.6(3)B of the Standard Specifications. Fittings shall be in accordance with Section 9-30.6(4) of the Standard Specifications.
		Lining	None.
		Coating	None.
		Joints	Butt heat fusion welded in accordance with pipe manufacturer's recommendation.

Remarks: *in accordance with the Section 7-15 of the Standard Specifications and the Uniform Plumbing Code.

END OF SECTION

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SECTION 22 13 13
PIPE SUPPORT SYSTEMS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This Section specifies pipe hangers, brackets, and supports. Pipe support system shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, structural attachments, and other accessories necessary for a complete installation and specified herein.

1.02 STANDARDS AND CODES

All pipe support 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.

ANSI A13.1	Piping and Piping System
ANSI B31.1	Power Piping
ASME	Boiler and Pressure Vessel Code
ANSI/MSS SP-58	Pipe Hangers and Supports C Materials, Design, and Manufacture
ANSI/MSS SP-69	Pipe Hanger and Supports C Selection and Application
SMACNA	Seismic Restraint Manual C Guidelines for Mechanical Systems
UPC	Uniform Plumbing Code

1.03 SUBMITTALS

A. In accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Manufacturer's technical data for all hangers, brackets, supports and documentation of conformance with appropriate standards and these specifications.
2. Location of pipe supports, including type of structural and pipe attachments, shown on the Drawings and/or specified under Paragraph 1.03 of Section 22 13 00 – Pipe.

PART 2 : PRODUCTS

2.01 GENERAL

A. The Contractor shall provide, and install pipe support systems which include hangers, brackets, supports, anchors, expansion joints, and structural attachments. The support system shall be pipe rack, trapeze pipe hangers or individual pipe clamps, hangers, supports and structural attachments as specified herein and as shown in the Drawings. The support system shall be provided in conjunction with the pipe to be supported. Seismic restraints shall be provided in accordance with SMACNA Manual as referenced in Paragraph 1.03, and as required by building codes.

B. In certain locations, pipe supports, anchors, and expansion joints have been indicated on the Drawings, but no attempt has been made to indicate every pipe support, anchor, and expansion joint. It shall be the Contractor's responsibility to provide a complete system of pipe supports.

C. All pipe support systems, including all accessories shall be Type 316 stainless steel.

2.02 PIPE RACKS AND TRAPEZE HANGERS

All components for pipe rack and trapeze shall be Unistrut or accepted equal.

2.03 ADJUSTABLE PIPE SUPPORT

As indicated on the drawings.

2.04 PIPE CLAMPS AND HANGERS

A. In areas where pipe racks and trapezes are not used, pipe shall be supported with clamp hanger support system. The clamps and hangers shall be fastened to threaded rods hanging from structural attachments. Pipe supports shall be selected for the size and type of pipe to which they are applied. Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item.

B. Pipe clamps and hangers shall be as manufactured by B-line by Eaton, National Pipe Hanger Corporation, or accepted equal.

2.05 STRUCTURAL ATTACHMENTS

Structural attachments shall be concrete insert channels or individual inserts for new concrete, and surface-mounted channel or individual inserts for existing concrete. All structural attachments including all accessories shall be Type 316 stainless steel and shall be provided by a single manufacturer. Structural attachments shall be as manufactured by Unistrut Corporation or accepted equal.

2.06 CHANNEL-TYPE PIPE CLAMP ASSEMBLY

A. Channel-type pipe clamp assembly shall consist of a channel section, pipe clamp or clamps, and channel attachment bolts. The channel shall be Unistrut Corp, P1000, $1^5/_8$-inch Single Channel. Length shall be as required to accommodate the pipe clamp or clamps, and anchor bolts. Length shall be pipe outside diameter plus 6 inches minimum.

B. The pipe clamp shall be Unistrut, P1100 Series (Conduit) or P2000 Series (Pipe).

C. Anchor bolts shall be type 316 stainless steel, type as required for mounting surface. A minimum of two bolts shall be used for each channel. Bolt size shall be ½-inch diameter.

PART 3 : EXECUTION

3.01 DESIGN

A. Pipe support system shall be designed in accordance with applicable reference standards specified in Paragraph 1.03. Pipe supports shall be designed and selected to withstand seismic loads per the UBC, and shall adhere to the following:

1. Weight balance calculations shall be made to determine the required supporting force at each pipe support location and the pipe weight at each equipment location. Design loads for inserts, clamps, and other support items shall not exceed the manufacturer's recommended loads.
2. Pipe supports shall be able to support the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment. Allow clearances for pipe expansion and contraction.
3. Wherever possible, pipe attachments for horizontal and vertical piping shall be channel-type pipe clamp assemblies, or as shown on the pipe support detail sheet. Horizontal or vertical pipes should be supported preferably at locations of least vertical movement.
4. All pipe supports shall provide a means of vertical adjustment after erection.
5. Where practical, riser pipe shall be supported independently of the connected horizontal piping. Pipe support attachments to the riser piping shall be riser clamps.

3.02 INSTALLATION

A. Pipe support system shall be installed strictly in accordance with standards and codes referenced in Paragraph 1.03, and recommendations of the piping support system manufacturer and piping manufacturer.

B. All piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports.

C. Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be copper-plated. Those portions of pipe supports that contact other dissimilar metals shall be rubber- or vinyl-coated.

D. Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead ending. Anchors shall be located as required to force expansion and contract movement to occur at expansion joints, loops, or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints.

E. Pipe supports and expansion joints are not required in buried piping, but concrete thrust blocking or other approved anchorage shall be provided as indicated on the Drawings or specified in other sections.

END OF SECTION

SECTION 22 13 15
VALVES: BASIC REQUIREMENTS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section Includes:

1. General requirements for valves, actuators, and valve appurtenances.

1.02 QUALITY ASSURANCE

A. REFERENCED STANDARDS

1. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. ASTM International (ASTM):
   a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
3. American Water Works Association (AWWA):
   a. C507, Standard for Ball Valves, 6 IN through 48 IN.
   b. C509, Standard for Resilient-Seated Gate Valves for Water Supply Service.
   c. C550, Standard for Protective Coatings for Valves and Hydrants.
4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
   a. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

1.03 DEFINITIONS

A. The following are definitions of abbreviations used in this Specification Section or one (1) of the individual valve sections:

1. CWP: Cold water working pressure.
2. WOG: Water, oil, gas working pressure.
3. WWP: Water working pressure.

1.04 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
    c. Valve pressure and temperature rating.
    d. Valve material of construction.
    e. Special linings.
    f. Valve dimensions and weight.
    g. Valve flow coefficient.
2. Test reports.
3. Operation and Maintenance Manuals:

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

B. Submit request for substitution in accordance with Division 1 of the WSDOT Special Provisions.

2.02 MATERIALS

Refer to individual valve Specification Sections.

2.03 VALVE ACTUATORS

A. VALVE ACTUATORS - GENERAL

1. Provide actuators as shown on Drawings or specified.
2. Counterclockwise opening as viewed from the top.
3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
4. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 foot-pounds torque on the operating nut.
5. Unless otherwise specified, actuators for valves to be buried, submerged, or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.

6. Extension stem:
    a. Install where shown or specified.
    b. Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.
    c. Pin all stem connections.
    d. Center in valve box or grating opening band with guide bushing.

B. BURIED VALVE ACTUATORS

1. Valve boxes shall be installed on all buried valves. Provide valve boxes with heavy top sections with drop in covers. Valve boxes shall be screw or slide type adjustable cast iron valve box, 5-1/4 IN minimum diameter, 3/16 IN minimum thickness, and identifying cast iron cover rated for traffic load or as shown on the Drawings. Cover shall have applicable service designation (i.e. WATER, SEWER, etc.) cast in it. All parts of the valve boxes, bases, and covers shall be coated with hot bituminous varnish, except the parts set in concrete shall be galvanized.
2. Box base to enclose buried valve gear box or bonnet.
3. Provide 2 IN standard actuator nuts complying with AWWA C500, Section 3.16.
4. Provide at least two (2) tee handle keys for actuator nuts, with 5 FT extension between key and handle.
5. Extension stem:
    a. Provide for buried valves greater than 3 FT below finish grade.
    b. Extend to within 6 IN of finish grade.
    c. Properly support shafts.
6. Provide concrete pad encasement of valve box as shown for all buried valves, unless shown otherwise.

C. EXPOSED VALVE MANUAL ACTUATORS

1. Provide for all exposed valves not having electric or cylinder actuators.
2. Provide handwheels for gate valves:
    a. Size handwheels for valves in accordance with AWWA C500.
3. Provide nut operator as specified above for exposed gate valves where shown on the Drawings.
4. Provide lever actuators for ball valves 3 IN DIA and smaller:
    a. Provide at least one (1) lever for each type and size of valve furnished.
5. Gear actuators required for ball valves 4 IN DIA and larger.
6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.

2.04 FABRICATION

A. END CONNECTIONS

1. Provide the type of end connections for valves as required in the Piping System Specifications presented in Section 22 13 11 – Piping Systems or as shown on the Drawings.
2. Comply with the following standards:
    a. Threaded: ASME B1.20.1.
    b. Flanged: ASME B16.1, Class 125 unless otherwise noted or AWWA C207.
    c. Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.
    d. Soldered: ASME B16.18.
    e. Grooved: Rigid joints per Table 5 of AWWA C606.
3. Refer to individual valve Specification Sections for specifications of each type of valve used on Project.
4. Nuts, Bolts, and Washers:
    a. All nuts, bolts, and washers shall be Type 304 or 316 stainless steel.
5. Wetted or internal to be bronze or stainless steel:
    a. Exposed to be zinc or cadmium plated.

B. EPOXY INTERIOR COATING: Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. PAINTING REQUIREMENTS: Comply with Specification Section 09 96 00 – Painting and Protective Coatings.

C. SETTING BURIED VALVES

1. Locate valves installed in pipe trenches where buried pipe indicated on Drawings.
2. Set valves and valve boxes plumb.
3. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
4. Install in closed position.
5. Place valve on concrete footing in trench to prevent settling and excessive strain on connection to pipe.

6. After installation, backfill up to top of box for a minimum distance of 4 FT on each side of box.

D. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.

E. For grooved coupling valves, install rigid type couplings or provide separate support to prevent rotation of valve from installed position.

F. For threaded valves, provide union on one (1) side within 2 FT of valve to allow valve removal.

G. Install valves accessible for operation, inspection, and maintenance.

3.02 ADJUSTMENT

A. Adjust valves, actuators, and appurtenant equipment to comply with Division 0/1:

1. Operate valve, open and close at system pressures.

END OF SECTION

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SECTION 22 13 15.13
GATE VALVES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section Includes:

1. Resilient wedge gate valves for water and wastewater service.

1.02 QUALITY ASSURANCE

A. REFERENCED STANDARDS

1. ASTM International (ASTM):
   a. D429, Standard Test Methods for Rubber Property - Adhesion to Rigid Substrates.
2. American Water Works Association (AWWA):
   a. C509, Standard for Resilient-Seated Gate Valves for Water Supply Service.
   b. C515, Standards for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Systems.
   c. C550, Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.
3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
   a. SP-9, Spot Facing for Bronze, Iron and Steel Flanges.

1.03 DEFINITIONS

A. OS&Y: Outside Screw and Yoke.

B. NRS: Non-rising Stem.

C. RS: Rising Stem.

1.04 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Product technical data per Specification Section 22 13 15 – Valves: Basic Requirements.
2. Operation and Maintenance Manuals.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

B. Submit request for substitution in accordance with the WSDOT Division 1 Special Provisions.

2.02 VALVES: POTABLE AND WASTEWATER

A. Resilient Wedge Gate Valves, 2 to 18 IN (Water, Wastewater Application):

1. Comply with AWWA C509 or AWWA C515.
2. Materials:
    a. Stem and stem nut: Bronze:
        1) Wetted bronze parts in low zinc bronze.
        2) Aluminum bronze components: Heat treated.
    b. Body, gate: Ductile iron.
    c. Resilient wedge: Fully encapsulated rubber wedge per ASTM D429.
    d. Seating rubber: EPDM elastomer.
    e. Nuts and bolts for connecting bonnet and body shall Type 304 stainless steel. Bolts may be regular square or hexagonal heads confirming to ANSI B18.2.1. Metric size socket head cap screws are not allowed.
    f. Interior lining and exterior coating shall be fusion bonded epoxy meeting the requirements of AWWA C550.
3. Design requirements:
    a. Minimum 150 psig cold water working pressure.
    b. Buried: NRS, O-ring stem seal, 2 IN square operating nut.
    c. Exposed: NRS, O-ring, stem seal, handwheel.
    d. Counterclockwise open rotation.
    e. Fusion bonded epoxy coating interior and exterior except stainless steel and bearing surfaces:
        1) Comply with AWWA C550.
        2) Wetted bronze parts in low zinc bronze.
        3) Aluminum bronze components: Heat treated.
    f. Ends to match connecting piping.
4. Acceptable manufacturers:
    a. Kennedy.

b. M & H.

2.03 ACCESSORIES

Refer to Section 22 13 15 – Valves: Basic Requirements for actuator requirements.

2.04 FABRICATION

A. Provide valves with clear waterways the full diameter of the valve.

B. Spot valves in accordance with MSS SP-9.

C. Valves shall be supplied with O-rings at all pressure retaining joints. No flat gaskets shall be allowed.

D. Stem O-rings above thrust collar shall be fully replaceable with the valve fully opened and subject to full pressure.

E. Valve waterways shall be smooth, unobstructed, and free of all pockets, cavities, and depressions in the seat area.

PART 3 : EXECUTION

3.01 INSTALLATION

See Specification Section 22 13 15 – Valves: Basic Requirements.

END OF SECTION

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SECTION 22 13 15.23
CHECK VALVES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section Includes:

1. Swing and duckbill type check valves for wastewater service.

1.02 QUALITY ASSURANCE

A. REFERENCED STANDARDS

1. American Water Works Association (AWWA):
   a. C508, Standard for Swing-Check Valves for Waterworks Service, 2 IN through 24 IN NPS.
2. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
   a. SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.03 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. See Specification Section 22 13 15 – Valves: Basic Requirements.

B. Operation and Maintenance Manuals.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, manufacturers listed under the valve with types are acceptable.

B. Submit request for substitution in accordance with the WSDOT Division 1 Special Provisions.

2.02 SWING CHECK VALVES

A. SWING CHECK VALVES (WASTEWATER)

1. Comply with AWWA C508.
2. Acceptable manufacturers:
   a. M&H.
   b. Kennedy.

3. Materials:
    a. Body and cover: Cast iron, ASTM A126, Class B.
    b. Seat ring, hinge: Bronze, AWWA C508.
    c. Disc: Cast iron, ASTM A126, Class B with rubber face.
    d. Hinge shaft: Stainless Steel, ASTM 276, type 304.
    e. Stuffing box, follower and gland: Bronze, AWWA C508.
    f. Interior lining and exterior coating shall be fusion bonded epoxy meeting the requirements of AWWA C550.
4. Design requirements:
    a. Integral flanged ends, flat faced and drilled per ANSI B16.1 Class 125.
    b. 175 psig working pressure and 350 psig hydrostatic pressure.
    c. Valves shall be provided with one outside lever and spring. Spring tension shall be adjustable. The valve design shall permit mounting levers and springs on either side of the valve body.
    d. Valve shall be provided with a clear opening equal to or greater than the connection piping, with no raised seating surface. Seats shall be threaded onto the body and shall be replaceable.
    e. Constructed to permit top entry for complete removal of internal components without removing the valve from the line.

2.03 DUCKBILL TYPE CHECK VALVE

A. Elastomeric valves shall be rubber, flow operated check type. The port area shall contour down to a duckbill, which shall allow passage of flow in one direction while preventing reverse flow.

B. When line pressure inside the valve exceeds the backpressure outside the valve by 1-inch of water, the line pressure shall force the bill of the valve open, allowing flow to pass. When backpressure exceeds the line pressure by the same amount, the bill of the valve shall be forced closed. The valve shall be capable of withstanding 8-feet of backpressure without leakage.

C. Valves shall be slip on, flat bottom, offset –bill design and attach to a plain end pipe with type 316 stainless steel mounting bands.

D. Valves shall be sized in accordance with the pipe size and type as shown on the Drawings.

E. All elastomeric check valves shall be Series TF-1 as manufactured by Red Valve Company or accepted equal.

PART 3 : EXECUTION

3.01 INSTALLATION

A. See Specification Section 22 13 15 – Valves: Basic Requirements.

B. Install in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 22 13 15.33
AIR VACUUM VALVES*

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section Includes:

1. Combination air vacuum valves for wastewater service.

1.02 QUALITY ASSURANCE

A. REFERENCED STANDARDS

1. American Water Works Association (AWWA):

a. C512, Standard for Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

1.03 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. See Specification Section 22 13 15 – Valves: Basic Requirements.

B. Operation and Maintenance Manuals.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, manufacturers listed under the valve with types are acceptable.

B. Submit request for substitution in accordance with the WSDOT Division 1 Special Provisions.

2.02 COMBINATION AIR VACUUM VALVES

A. Comply with AWWA C512.

B. Acceptable valves:

1. A.R.I. Model D-020 or D-025.
2. Approved equal.

C. Materials:

1. Body and cover: Stainless Steel.
2. Internal metal parts: Corrosion resistant stainless steel.

3. Float: stainless steel.
4. Valve coating: fusion bonded epoxy according to DIN 30677-2.

D. Design requirements:

1. Integral flanged end, flat faced and drilled per ANSI B16.1 Class 125.
2. Working pressure range: 3 to 250 psi.
3. Conical body shall be designed to maintain the maximum distance between the liquid and the sealing mechanism and still obtain minimum body length.
4. Independent spring-guided linkage between the lower float/rod assembly and the upper float sealing mechanism shall allow free movement of the float and rod. Vibrations and movement of the lower float due to turbulence shall not unseal the upper float sealing mechanism.

PART 3 : EXECUTION

3.01 INSTALLATION

A. See Specification Section 22 13 15 – Valves: Basic Requirements.

B. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 13 19
PIPE APPURTENANCES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Piping appurtenances include, but are not limited to mechanical couplings, unions, sleeves, transition fittings, link type wall seals, flexible boot connections, drop bowl assembly, odor control cartridges, tracer wire, and grooved couplings.

1.02 STANDARDS AND CODES

ASTM A 276 Standard Specification for Stainless Steel Bars and Shapes

ASTM A 536 Standard Specification for Ductile Iron Castings

ASTM F 593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

AWWA C207 Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)

Standard Specifications - 2020 WSDOT Standard Specifications for Road, Bridge, and Municipal Construction

1.03 SUBMITTALS

A. In accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Catalog information.
2. Manufacturer’s installation instructions.

PART 2 : PRODUCTS

2.01 SLEEVE-TYPE (FLEXIBLE) COUPLINGS

A. Manufacturers, one of the following or equivalent.

1. Dresser, Inc. Style 253.
2. Romac Industries, Inc. Style 501.

B. MATERIAL: Ductile iron in accordance with ASTM A 536.

C. BOLTS AND HEX NUT MATERIAL: Type 316 stainless steel in accordance with ASTM F 593.

D. COATING AND LINING: Manufacturer’s standard fusion bonded epoxy.

E. SLEEVE LENGTH: 7 inches for pipe 4 to 8 inches in diameter; 12 inches for pipe 10 to 12 inches in diameter; and 14 inches for pipe 16 to 20 inches in diameter.

2.02 RESTRAINED FLEXIBLE COUPLINGS

A. Manufacturers, one of the following or equivalent.

1. Romac Industries, Inc. Alpha.
2. Ebaa Iron Inc., Mega-Coupling

B. DESIGN: Accommodate 4 degrees working deflection per end of coupling.

C. RATED WORKING PRESSURE: 350 psi.

D. MATERIAL: Ductile iron in accordance with ASTM A 536.

E. BOLTS AND HEX NUT MATERIAL: Type 304 stainless steel in accordance with ASTM F 593.

F. COATING AND LINING: Manufacturer’s standard fusion bonded epoxy.

2.03 RESTRAINED FLANGED COUPLING ADAPTER

A. Manufacturers, one of the following or equivalent.

1. Romac Industries, Inc. Style RFCA or Alpha.
2. Star Pipe Products, StarFlange Series 3200.
3. Ebaa Iron Inc., Mega-Flange

B. FLANGE, BODY, FOLLOWER RING, RESTRAINING LUG AND RESTRAINING BOLT MATERIAL: Ductile iron in accordance with ASTM A 536.

C. Bolt heads shall be designed to twist off when proper torque has been applied.

D. BOLTS AND HEX NUT MATERIAL: Type 316 stainless steel in accordance with ASTM F 593.

E. FLANGE DESIGN: Class D steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.

F. COATING AND LINING: Manufacturer’s standard fusion bonded epoxy.

G. Coupling shall allow angular deflection after assembly.

H. Use serrated restraints on AWWA C900 PVC pipe.

I. On HDPE pipe, install with internal Type 316 stainless steel stiffener, sized to encompass the full bearing length of the restraint device.

2.04 MECHANICAL JOINT RESTRAINT COUPLINGS

A. For use on Ductile Iron Pipe:

1. EBBA Iron, MEGALUG Series 1100 Mechanical Joint Restraint
2. Romac Alpha
3. Accepted equal.

B. For use on HDPE Pipe:

1. EBBA Iron, Series 2000PV HDPE Restraint, or accepted equal.
    a. Install with internal type 316 stainless steel stiffener, sized to encompass the full bearing length of the restraint device.

C. POTABLE WATER

1. HDPE to 316 Stainless Steel – butt fusion x male threaded connection.
2. Match pressure rating and material types of connecting piping.
3. Suitable for potable water.

2.05 UNIONS

Unions 2 inches and smaller shall be threaded joint, malleable iron type. Unions 2½ inches and larger shall be flanged type, 150-pound flanges.

2.06 DIELECTRIC UNIONS

A. Provide between ferrous and nonferrous piping and where otherwise required for electrically insulated connection, as shown.

B. MATERIALS: Galvanically compatible with piping to which attached and pressure ratings suitable for system working pressures.

C. UNIONS 2 INCHES AND SMALLER: Screwed or solder-joint type.

D. UNIONS 2½ INCHES AND LARGER: Flanged type, complete with bolt insulators, dielectric gasket, bolts, and nuts.

2.07 LINK TYPE WALL SEALS

A. TYPE: Interconnected synthetic rubber links shaped and sized to continuously fill annular space between pipe and wall sleeve opening.

B. FABRICATION: Assemble interconnected rubber links with ASTM A276, Type 316 stainless steel bolts, nuts, and pressure plates.

C. SIZE: According to manufacturer's instructions for the size of pipes shown to provide a watertight seal between pipe and wall sleeve opening, and to withstand a hydrostatic head of 40 feet of water.

D. MANUFACTURER: Thunderline Link-Seal or accepted equal.

2.08 FLEXIBLE BOOT CONNECTION

A. Flexible rubber pipe to manhole connector in accordance with ASTM C923.

B. Suitable for raw sewage application.

C. Stainless steel band construction.

D. MANUFACTURER: Trelleborg, Kor-N-Seal, or accepted equal.

2.09 PIG LAUNCH

A. Butt Welded steel, minimum thickness of 1/4-inch.

B. Flanges and closures: 150 lb rating.

C. Bolts and nuts: stainless steel, type 316.

D. Hinged enclosure on the retriever tube:

1. T-Bolt style, hinged, horizontal 150 lb closure
2. Closure gasket shall be Buna N.
3. Provide manufacturer's statement of code compliance.
4. Approved manufacturers:
    a. Sypris Solutions
    b. Accepted equal

E. Coat interior and exterior of completed launch with fusion bonded epoxy in accordance with AWWA C213.

1. Provide stainless steel, Type 304 adjustable snubber as recommended by fabricator to keep the pig properly in place within the launcher prior to launching.

F. Pig Launch Approved Manufacturers:

1. Flowmore Services.
2. TD Williamson.
3. Accepted equal

2.10 DROP BOWL ASSEMBLY

A. The drop bowl assembly shall be a plastic composite collection device that facilitates the controlled drop of wastewater into a wet well or manhole.

1. Drop bowl and drop pipe size shall be based on inlet sewer size as recommended by the manufacturer.
2. Drop pipe shall be SDR 35 PVC, Schedule 40.

3. Connect drop pipe to drop bowl with flexible coupler, Fernco type coupling with stainless steel hardware, or accepted equal.
4. Bevel cut outlet of drop pipe at 45-degree angle for wet well use as shown on the Drawings.
5. Provide 45-degree, solvent weld bend at outlet for manhole use as shown on the Drawings.
6. Provide each drop bowl with a hood designed for higher velocity flows. Drill and attach to drop bowl with manufacturer's standard stainless steel hardware in accordance with manufacturer's instructions.
7. Support drop bowl assembly to concrete wall with manufacture's standard stainless steel hardware, anchors and recommended spacing.
    a. Provide two additional supports and mounting hardware (in addition to manufacturer's recommended minimum) per drop bowl for drop bowls installed in a wet well. Contractor shall install additional supports for drop bowls in the wet wells as directed by the County Construction Manager.
8. Manufacturer shall be RELINER/Duran Inc. or accepted equal.

2.11 ODOR CONTROL CARTRIDGE

A. BioVent Cartridge by EZ Vent, LLC, or accepted equal.

1. Suitable for mounting inside Schedule 40 PVC pipe as shown on the Drawings.
2. 12-inch cartridge length.
3. Stainless steel construction with handle for removal.
4. 1-year supply of odor eliminating carbon.

2.12 TRACER WIRE

A. WIRE

1. 12 GA AWG.
2. Solid.
3. High density polyethylene insulation.
4. Suitable for wet, buried applications.

B. WIRE NUTS: Waterproof type.

C. SPLIT BOLTS: Brass.

2.13 GROOVED COUPLINGS

A. Provide where shown on the Drawings.

B. MATERIAL: Ductile iron per ASTM A-536.

C. Rigid type.

D. Type 316 stainless steel bolts and nuts.

E. Gasket suitable for raw wastewater applications.

F. Grooved couplings shall be manufactured by Victaulic Style 31, or accepted equal.

2.14 DISMANTLING JOINT

A. Body shall be ASTM A36 steel, fusion bonded epoxy coated.

B. Bolts and nuts shall be Type 316 stainless steel.

C. Tie rods shall be high tensile steel per ASTM A193 grade B7.

D. Dismantling joints shall be fully restrained.

E. Subject to compliance with the Contract Documents, dismantling joints shall be Romac DJ400 or approved equivalent.

2.15 WATERTIGHT FLASHING FOR METAL ROOF PENETRATION

A. Watertight flashing shall consist of an EPDM or silicone boot with flexible aluminum base. Install per manufacturer's instructions.

B. Watertight flashing shall be Dektite Original or accepted equal.

PART 3 : EXECUTION

3.01 GENERAL

A. Install in accordance with manufacturer's instructions.

B. Install centered without angular deflection, unless shown otherwise on the Drawings.

3.02 SLEEVE-TYPE COUPLINGS

A. Sleeve-type couplings shall be employed where shown on the Drawings or specified herein, as takedown couplings on large diameter pipelines, to provide flexibility in buried piping systems at connections to structures, and as a general pipe coupling where required or permitted by Section 22 13 00 – Pipe.

B. Sleeve-type couplings shall be installed in accordance with the specifications and the manufacturer's instructions.

3.03 RESTRAINED FLANGE COUPLING ADAPTERS

Restrained flange coupling adapters shall be installed in accordance with manufacturer's recommendations.

3.04 UNIONS

Unions shall be used as shown on the Drawings and, if not shown, shall be provided to permit easy assembly/disassembly of equipment and removal of valves.

3.05 DIELECTRIC UNIONS

Dielectric unions shall be used whenever two dissimilar pipe materials are joined.

END OF SECTION

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SECTION 22 13 29
EQUIPMENT GENERAL PROVISIONS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This Section specifies general requirements that are applicable to all equipment. The Contractor is responsible for ensuring that the equipment meets the requirements of this Section in addition to the specific requirements of each individual equipment Specification Section.

1.02 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions and Section 26 00 00 – Electrical, submit the following:

1. DRAWINGS AND DATA: Submit complete assembly, foundation, and installation drawings, together with detailed specifications and data describing materials, parts, devices, and other accessories used to manufacture each equipment item.
2. OPERATIONS AND MAINTENANCE MANUALS: Submit operation and maintenance manuals prepared by equipment manufacturers. The operation and maintenance manuals shall be in addition to shop drawings and any instructions or parts packed with or attached to the equipment when delivered.
3. ELECTRICAL CERTIFICATIONS: Refer to paragraph 2.07 – Electrical Labeling Requirements. Provide certifications that equipment and associated materials and devices are listed and labeled by a recognized independent testing laboratory and suitable for the intended use and/or classified area as shown on the electrical Drawings.

1.03 WARRANTY

A. The Contractor shall warrant to the Owner both the equipment construction, the functioning of the equipment system, and the equipment performance, as specified herein. The Contractor shall warrant the equipment for a minimum of twelve (12) months following successful acceptance testing, or eighteen (18) months following delivery, whichever is less.

B. The Contractor shall guarantee the equipment and control system to be free of defects in design, materials, and workmanship. As part of the guarantee, the Contractor shall indemnify and hold harmless the Owner and Engineer and their officers, agents, and employees against and from all claims and liability arising from all damage and injury due to defects in the equipment and related systems.

C. The Contractor shall make any and all repairs, replacements, modifications, and adjustments necessary to eliminate any and all defects in design, materials, and workmanship that are disclosed within the one-year warranty period. All repairs, replacements, modifications, and adjustments shall be started within twenty-four (24) hours of notification by telephone from the Owner, and shall be completed within a reasonable period of time. Should the Contractor fail to begin the work within 24 hours, or to complete the work within a reasonable period, the Owner may proceed to undertake or complete the work. In such event, the Contractor and his surety shall be liable for all costs incurred by the Owner.

1.04 PROTECTION

A. The Contractor will be responsible for the equipment in this Contract until it has been inspected, tested and accepted in accordance with the requirements of these specifications.

B. Box, crate, or otherwise completely enclose and protect all equipment during shipment, handling and storage.

C. Make provisions to protect all material and equipment against theft, injury or damage. Damaged goods will not be used in this work.

D. Protect equipment from exposure to elements and keep all items thoroughly dry at all times.

E. Store motors, electrical equipment, and other equipment with moving parts in weather tight warehouses at maintained temperature of 60ºF minimum.

F. Protect painted surfaces against impact, abrasion, discoloration and other damage. Repaint to original factory specifications all painted surfaces which are damaged prior to acceptance of equipment.

G. Protect electrical equipment, controls, and insulation against moisture or water damage.

1.05 ADAPTATION OF EQUIPMENT

A. Furnish equipment readily adaptable for installation and operation in the structure shown on the Drawings. Equipment furnished shall be compatible with all other equipment furnished.

B. Assume full responsibility for alteration of the planned structure to accommodate other types of equipment. Assume full responsibility for all modifications of mechanical and electrical controls, equipment, wiring, piping, as required to accomplish function contemplated by the Contract Documents.

C. Equipment which requires alteration of the structure, piping, and/or electrical work will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations.

D. Provide all such alterations free of extra cost to the Owner.

PART 2 : PRODUCTS

2.01 EQUIPMENT

A. Provide equipment in accordance with applicable sections of these Specifications.

B. Furnish each piece of equipment complete including other appurtenances that are specified or required for proper and safe operation.

C. All railings, stairs, guards, and platforms required to access equipment for operation and maintenance shall meet or exceed the most recent federal OSHA and state requirements.

D. Fabricate, assemble, erect, place and test all specified materials and equipment in full conformity with all contract document and manufacturer's recommendations.

E. Furnish any special tools or equipment required for proper maintenance, testing, or adjusting.

2.02 EQUIPMENT FOUNDATIONS, BASES AND PADS

A. All floor or floor stand-mounted equipment specified in Division 22 – Plumbing shall be set on concrete housekeeping pads.

1. The height of the pads shall be as recommended by the equipment manufacturer, as required to connect to piping, or as shown on the Drawings.
2. The height shall be sufficient to accommodate required anchorage devices.
3. The pads shall extend 2-inch minimum and 4 inches maximum beyond the machine base in all directions unless otherwise indicated on the Drawings or by the equipment manufacturer.
4. The top edges of the pads shall be chamfered.

B. Concrete work shall be in accordance with Section 03 00 00 – Concrete.

C. Anchor bolts shall be in accordance with Division 5.

2.03 NAMEPLATES

A. Nameplates shall be provided on each item of equipment and shall contain the specified equipment name or abbreviation and equipment number.

B. Equipment nameplates shall be engraved or stamped on corrosion resistant material and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins.

2.04 LUBRICANTS

A. Equipment shall be furnished with proper lubricants in sufficient quantities to allow for the startup and testing period. The type of lubricant shall be as specified.

B. With the equipment manufacturer's approval, the Contractor shall minimize the number of different types and brands of lubricants by consolidating the lubricants into the least number of different types required to adequately service the equipment.

C. Not less than 90 days before the date indicated for starting, testing, and adjusting equipment, the Contractor shall provide the Owner with five (5) copies of a list indicating the required lubricants, after consolidation, for each item of equipment.

D. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming continuous operation.

2.05 NOISE REQUIREMENTS AND CONTROLS

A. Unless otherwise specified, the maximum permissible noise level for a complete piece of equipment shall not exceed 85 dbA at 3 feet and comply with local ordinances.

1. A complete piece of equipment includes the driver and driven equipment plus any intermediate couplings, gears and auxiliaries.

B. Provide sound attenuating enclosure with easy access to regularly used components.

2.06 ELECTRICAL LABELING REQUIREMENTS

A. Electrical equipment and associated devices and materials shall be listed and labeled for the purpose and/or classified area (as shown on the plans) in which they are to be used by a recognized independent testing laboratory.

1. Three such organizations are:
    a. Underwriters Laboratories (UL).
    b. Canadian Standards Association (CSA).
    c. Electrical Testing Laboratories (ETL).
2. Independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.

B. When a product does not have or is not available with a testing laboratory listing or label for the purpose and/or classified area for which it is used, the product may be required by the inspection authority to undergo a special inspection and certification. Coordination and all costs and expenses for such inspections and certification will be considered the responsibility of the supplier/contractor and included in the contract price.

PART 3 : EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Equipment shall be installed in accordance with the equipment manufacturer's written installation instructions and the requirements of these specifications. The Contractor shall provide and pay for the services of a manufacturer's service engineer to review the installation and make final adjustments to the equipment unless the specifications specifically state that such services are not required.

B. Attention shall be given to design loadings of floors to assure that design loadings are not exceeded during installation of equipment. The Contractor shall be responsible for devising and maintaining installation procedures and techniques which will not overstress structural components.

C. The Contractor shall cover openings in equipment prior to, during and following installation to prevent dirt, rubbish or water from entering.

D. Equipment shall not be subject to electrical or mechanical shock. Damaged, dented or marred equipment shall be replaced or repaired in a manner satisfactory to the Owner, at the option of the Owner, at no additional cost to the Owner.

E. Miscellaneous materials shall be furnished and installed as required to provide a complete, operable equipment installation. Such miscellaneous materials shall include, but not be limited to, the following:

1. Stainless steel and brass shim stock.
2. Thread lubricants, pipe dope, gasket compounds, and sealers.
3. Non-hazardous solvents and cleaning compounds.
4. Welding rod and other expendable construction materials.
5. Paint for touchup of shop coatings.
6. Cribbing, jacks, slings, rigging, blocking, scaffolding, lifting eyes, and other erection materials.
7. Grout, grout forms and blocking.
8. Bolts, studs, nuts, and gaskets for makeup of connections to the equipment, securing the equipment to its supports, and to replace manhole gaskets damaged or misplaced during storage, inspection, cleaning, filling or placing into service.

F. Welding shall be performed as required to ensure complete and proper installation of the equipment. The following requirements shall apply:

1. The shielded metallic-arc welding process shall be used.
2. Welders and welder operators shall be certified as qualified by the ANSI, ASME, or AWS codes as applicable.
3. Welding procedures shall be in accordance with the following:
    a. ANSI – Code for Power Piping B31.1.

b. ASME – Boiler and Pressure Vessel Code.

c. AWS – Structural Welding Code D1.1.

4. Welding to equipment shall be in accordance with the equipment manufacturer's recommended procedures.

G. Grouting of equipment shall be in accordance with the provisions specified in Section 03 60 00 and as may be shown on the Drawings.

H. Cleaning and touchup of equipment shall be performed as follows:

1. Temporary protective coatings and foreign materials shall be completely removed prior to assembly and installation.

2. Shop-applied compounds shall be completely removed.

3. Compressed air shall be used to completely remove foreign materials from equipment components and interconnecting piping.

4. Weld spatter, burrs on cut surfaces, and sharp protrusions shall be removed to the satisfaction of the Engineer.

5. Loose paint shall be removed by sandpaper, wire brush, or paint scraper to the satisfaction of the Engineer.

6. Factory-applied prime coats shall be touched up in the field after installation is complete using touchup paint furnished by the equipment manufacturer.

7. Paint shall be applied by brush or spray and in accordance with the paint manufacturer's recommendations. Paint shall not be applied at temperatures below 50°F.

3.02 EQUIPMENT MAINTENANCE PRIOR TO INITIAL OPERATION

A. Mechanical equipment and appurtenances shall be properly oiled and lubricated prior to being operated.

B. The equipment installation shall include furnishing and installing oil, grease, and protective fluids required for initial operation.

C. The Contractor shall record the date, type, and quantity of lubricant and/or oil initially installed.

D. Such records shall be submitted to the Owner prior to initial operation of the equipment.

3.03 PAINTING

A. Equipment shall be painted in accordance with Section 09 96 00 – Painting and Protective Coatings, except as specified herein.

B. Equipment with approved factory finish shall not be painted.

C. Electrical equipment, as listed below, with standard factory-applied enamel coating systems shall not be painted:

1. Panel boards.
2. Electrical panels.
3. Switchboards.
4. Switchgear.
5. Safety switches.
6. Motor starter equipment.
7. Motor control centers.
8. Raceways and cable trays.
9. Transformers.
10. Power circuit breakers.

3.04 SPARE PARTS STORAGE AND MARKING

A. Spare parts shall be wrapped in weatherproof material and packed in painted wooden boxes with hinged cover and hasp lock.

B. Each box shall be clearly labeled on the front and top as to its contents.

C. No box shall weigh more than 150 pounds when full.

3.05 TESTING AND STARTUP

Preoperational checkout, operational testing and startup shall be performed in accordance with Section 1-05.11 and as may be specified for each equipment item.

3.06 CONTINUING ADJUSTMENTS

The Contractor shall provide such continuing adjustments as are necessary to insure proper operation of all equipment after occupancy of the project and for a period of one year after Date of Substantial Completion.

3.07 OPERATOR TRAINING

A. The Contractor shall provide and pay for the services of qualified representatives of the equipment, provided under this contract, to instruct the Owner’s personnel in the proper operation and maintenance of the equipment.

B. Training time shall be as specified in individual Specification Sections.

C. Instruction time shall be in addition to, and shall not be done simultaneously with, equipment startup and acceptance testing.

END OF SECTION

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SECTION 22 13 29.16
SUBMERSIBLE WASTEWATER PUMPS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies submersible non-clog pumps for municipal sewage.

B. The Owner has negotiated a “not to exceed” price for procuring the equipment and Source/Field Quality Control services associated with this Specification Section. A copy of the Manufacturer’s “not to exceed” price is included in Appendix E.

C. In addition to the “not to exceed” price, the Contractor shall include in its Bid, all additional costs for work required by the Contractor which is not included in the “not to exceed” price, but is required to provide a complete operating system and administer the Manufacturer’s “not to exceed” price including, but not necessarily limited to:

1. Coordination of the submittals.
2. Equipment unloading.
3. Handling, storing, installing, starting-up, testing, demonstrating, and all other incidentals required to place the pre-negotiated equipment into service.

1.02 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Technical literature, bulletins, and/or catalog cuts of the equipment.
2. Performance curves.
3. Quality control test results.
4. Materials of construction.
5. Complete installation instructions, including electrical and mechanical requirements.
6. Operations and Maintenance Manuals.

B. Pump Manufacturer’s recommendation of wet well filleting and extent of flat area as shown on the Drawings.

1.03 WARRANTY

A. The pump manufacturer shall warrant the pumps, including components and motor, against defects in workmanship and materials for a period of five (5) years under normal use and service.

B. The pump manufacturer shall warrant the guide system (including guide, cables or rails, and brackets) against defects in workmanship and materials for a period of ten (10) years under normal use and service.

C. The pump manufacturer shall fully warrant the impeller against clogging for a period of one year under normal use and service.

D. Pump manufacturer warranties shall be in published form and shall apply to all similar units.

1.04 QUALITY CONTROL

A. Perform equipment tests in accordance with the Hydraulic Institute's - Submersible Pumps for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Tests.

1. Tests shall be performed on the actual assembled pumps to be supplied; prototype model tests are not acceptable.
2. Tests shall cover a range from shut-off to a minimum 20 percent beyond specified design capacity.

B. Conduct test per above specifications on all supplied pumps, generating a curve showing actual flow, head, BHP, and hydraulic efficiency.

C. Obtain the submersible sewage pumps from one source and a single manufacturer.

PART 2 : PRODUCTS

A. Subject to conformance with the Contract Documents, the following manufacturers are acceptable:

1. Flygt.
2. No substitutions.

B. PERFORMANCE AND CONDITIONS OF SERVICE: The pumps shall operate over the range of flows and heads specified below. Motor horsepower shall not exceed the values specified, and the hydraulic efficiency shall be equal to or higher than those listed. A separate table is provided for Pump Station 19 and Pump Station 31.

Submersible Pumps – Pump Station 19	
Number of Pumps (1 plus 1 standby)	2
Design Point – One Pump Operation (gpm/ft)	1,440/96
Minimum Hydraulic Efficiency (one pump)	73%
Max. Motor Horsepower	60
Max. Speed, RPM	1,775
Variable Speed	No
Voltage/Cycle/Phase	460/60/3
Max. Amperage per Phase (full load)	96
Nominal Discharge Diameter, inches	6
Impeller Type	Semi-open, non-clog, adaptive
Material Pumped	Raw Municipal Sewage

Submersible Pumps – Pump Station 31	
Number of Pumps (1 plus 1 standby)	2
Design Point – One Pump Operation (gpm/ft)	150/28
Minimum Hydraulic Efficiency (one pump)	53%
Motor Horsepower	3.2
Max. Speed, RPM	3,340
Variable Speed	No
Voltage/Cycle/Phase	~~208/60/3 (VFD)~~ 480/60/30*
Max. Amperage per Phase (full load)	15.2
Nominal Discharge Diameter, inches	3
Impeller Type	Semi-open, non-clog, adaptive
Material Pumped	Raw Municipal Sewage

C. The total heads specified herein do not include internal pump losses.

D. Pumps shall operate without cavitation or vibration within the manufacturer's allowable operating range, with a submergence of one (1) foot above the impeller centerline.

2.02 PUMP DESIGN

A. The pumps shall be submersible non-clog type that is suitable for the application, each connected to a discharge connection of a minimum diameter as specified herein.

B. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact.

2.03 PUMP CONSTRUCTION

A. Provide pumps fabricated of the following materials:

Pump Components	Material
Pump Case	Cast Iron, ASTM A48, Class 35B
Motor Housing	Cast Iron, ASTM A48, Class 35B
Impeller	Hard iron, ASTM A532 (Alloy III A, 25% chrome cast iron)
Intermediate Housing (Backplate)	Cast Iron, ASTM A48, Class 35B
Discharge Base Elbow	Cast Iron, ASTM A48, Class 35B
Pump/Motor Shaft	Stainless Steel, AISI 431
Shaft Sleeve	Not allowed
Wear Ring, Case	Cast Iron, ASTM A48, minimum 200 Brinell
O-Rings	Nitrile Rubber (NBR)
Fasteners	Stainless Steel, Type 316
Mechanical Seal – Lower	Tungsten Carbide
Mechanical Seal – Upper	Tungsten Carbide
Guide Rails	Stainless Steel, ASTM A276 Type 316L
Lifting Chains	Stainless Steel, ASTM A276 Type 316L
Oil – All Uses (Seal Lubrication, Motor Cooling, etc.)	FDA Approved, Ecologically Safe
Power/Control Cable Jacket	Chlorinated Polyethylene Rubber

B. Furnish pump case, impeller, intermediate housing, and motor housing with smooth surfaces devoid of blow holes and other irregularities.

C. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory-applied polyamidoamine epoxy protective spray coating on the exterior of the pump.

D. Sealing design shall incorporate metal-to-metal contact between machine surfaces.

E. All major castings shall be produced in the manufacturer's own foundry, under the manufacturer's direct supervision.

2.04 COMPONENTS

A. GENERAL

1. Provide pumps capable of handling solids, fibrous materials, sludge and other matter found in raw, unscreened municipal wastewater.
2. Where watertight sealing is required, machine and fit mating surfaces with O-rings.
3. Provide with heavy duty lift lugs or hoisting bail designed for lifting the entire pump and motor assembly.

B. IMPELLER AND WEAR RINGS

1. Provide semi-open, multi-vane, back-swept, non-clog type impeller.
2. Statically and dynamically balance impeller.

C. SHAFT

1. Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings are not acceptable.

D. MECHANICAL SEAL

1. Provide two totally independent mechanical shaft seals, installed in tandem, each with its own independent spring system acting in a common direction.
2. Install the upper seal in an oil-filled chamber with drain and inspection plug (with positive anti-leak seal) for easy access from external to the pump.
3. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.
4. Do not provide seals with the following characteristics:
    a. Conventional double mechanical seals with single or multiple springs acting in opposed direction.
    b. Cartridge-type mechanical seals.
    c. Seals with materials other than those specified.
    d. Seals using the impeller hub as a mounting surface.

E. BEARINGS

1. Furnish upper and lower bearings, single row (preferred) or double row as needed to provide a B10 life of, at minimum, 50,000 hours at anticipated axial and radial loadings.
2. Provide sealed, shielded (permanently lubricated) bearings.

F. MOTOR

1. Provide a motor that is squirrel cage, induction in design, housed in completely water-tight and air-filled chamber, with a minimum 1.15 service factor.
2. Insulate the motor stator and stator leads with, at minimum, Class H insulation rated for 180 degrees Celsius total temperature.
3. Provide motor cooling by the following method:
    a. Provide adequately rated motor with sufficient surface area for ambient-only cooling.
4. Provide motors that are capable of operating for at least 2 hours in a dry mode without damage to motor or seals.

5. Provide motors that are designed, rated, and warranted for continuous operation at 40 degrees Celsius, temperature rise not to exceed 80 degrees Celsius, capable of 30 evenly spaced starts per hour.
6. Do not provide motors that contain in excess of 2 gallons of oil (combined total for cooling and seals), or that contain other than an FDA approved, ecologically safe oil.
7. Pump and motor package to be FM approved, Class 1, Division 1, Group C & D for service in hazardous locations as defined by the National Electric Code (NEC).
8. Include pump cord listed as suitable for Class 1, Division 1, Group C & D environments.
    a. Provide shielded cable for pump motors connected to variable frequency drives.
    b. Provide signal cores integral to overall cable for connection to Thermal/Leakage monitoring relay. Separate cables for leakage, motor windings thermostat, or both signals are not acceptable.

G. THERMAL/LEAKAGE RELAY

1. Provide MiniCAS thermal/leakage relay with mounting socket for each pump installed.
2. Provide relay and relay base to system integrator (Division 40) for integration to controls.

H. PROTECTION

1. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. Set temperature monitors at levels recommended by pump manufacturer. When activated, switches shall activate an alarm and the pump shall shut down.
2. Leak detection sensors shall be provided to detect water in the stator chamber, cable entry chamber, and mechanical seal woil chamber. The leak sensors shall utilize a float switch to detect the presence of water. When activated, the sensors shall activate an alarm only. The pump shall not be shut down.

2.05 APPURTENANCES

A. GUIDE SYSTEM

1. Pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts, or other fasteners.

2. Pumps shall connect to permanently mounted discharge connections by simple downward motion, without rotation; guided by at least two (per pump) non-load-bearing, Type 316L stainless steel, non-sparking, guide rails permanently installed in the wet well extending from the top of the station to the discharge connection. Final connection shall ensure zero leakage between the pump and discharge connection flange. Guide rail connectors, if required, shall be manufactured by the pump supplier.

3. Pumps shall automatically connect to the discharge elbow when lowered and sealed by a profile gasket or machined metal-to-metal watertight contact.

4. Discharge connection/guide system shall be such that no part of the pump bears directly on the floor of the wet well.

5. Each pump shall be fitted with a Type 316L stainless steel chain and cable guideline with grip-eye lifting device of adequate strength and sufficient length for raising and lowering pumps. The working load of the lifting system shall be at least 50 percent greater than the pump unit weight.

6. Cable holder with safety hook for each pump to be Type 316L stainless steel.

B. POWER AND CONTROL CABLE

1. Combined power cable and control cable of adequate length to allow a unit to be wired as shown on the Drawings without splicing. Cables should be suitable for the application, sized in accordance with NEC requirements.

2. Cable entry sealing system:

   a. Cable terminal box on side of motor housing, with cable entry sealed to ensure that no entry of moisture is possible into the motor terminal area even if the cable is damaged or severed below water level.

   b. Control cable shall contain the required conductors for the temperature and seal leak detection systems.

C. SPARE PARTS: supply one set of the following spare parts for each pump station:

1. Basic Repair Kit (Mechanical seals, O-rings, Bearings, etc.).

2. Sleeve Assembly.

3. N-Impeller and Insert Ring.

4. Two Flygt MiniCAS thermal/leakage relays with mounting sockets.

2.06 COATINGS

Factory coat pumps in accordance with Section 09 96 00 – Painting and Protective Coatings.

2.07 CONTROLS

Pump control requirements in Section 40 90 10 – Programming Wastewater Pump Stations.

PART 3 : EXECUTION

3.01 INSTALLATION

A. See Equipment General Provisions, Section 22 13 29 – Equipment General Provisions.

B. Install pumps as shown on the Drawings and as recommended by the manufacturer.

C. Pumps shall be set plumb with no stresses on the pump discharge. Vibration of the complete pump assemblies shall be within the limits recommended by the applicable standards of the Hydraulic Institute.

3.02 START-UP AND TRAINING SERVICE

A. The equipment manufacturer shall furnish the services of a qualified factory-trained field service representative for at least a one (1) day site visit per pump station to inspect, check, service, adjust and make corrections to the installations. Additionally, after the pumps have been completely installed and wired, the Contractor shall have the manufacturer do the following:

1. Megger stator and power cables.
2. Check seal lubrication.
3. Check for proper rotation.
4. Check power supply voltage.
5. Measure motor operating load and no-load current.
6. Check level control operation and sequence.

B. Service representative shall submit a written report certifying that the equipment has been properly installed and checked.

C. Field test all pumps after installation to demonstrate satisfactory operation. See Section 1-05.11 – Facility Startup, Testing and Training.

1. Furnish all labor, materials, tools, equipment, incidentals, and services for developing a sufficient supply of potable water for functional testing. No extra payment will be made for delivering or placing the water, or for the quantity used. Sufficient quantities of water shall be available to test the full range of the equipment.
2. Testing shall be done in the presence of the Engineer.
3. Furnish all labor, materials, tools equipment, instruments, and services necessary.

4. Any pump that fails to meet the requirements, will be modified, repaired or replaced at the Contractor's expense.

D. Instruct the Owner's personnel on the operation and maintenance of the pumping units for both pump stations. This shall be deemed to be a separate one-day visit to the site, independent of visits required for equipment checkout, testing, and startup unless noted otherwise or prior concurrence of the Engineer and Owner are received.

3.03 CLEANING

A. All materials and equipment shall be new and, therefore, shall require only a minimum amount of routine cleaning during or after installation.

B. All debris, grit, petroleum products, rust scale, construction by-products, and foreign matter shall be removed, and damaged coatings shall be repaired prior to final acceptance. All cleaning regimen suggested by the manufacturer shall be done.

END OF SECTION

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SECTION 22 13 43.19
BACKUP DIESEL WASTEWATER PUMP

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies the requirements for providing a diesel driven, skid mounted pump.

B. The Contractor's Bid shall include all costs for work required by the Contractor to provide a complete operating system including, but not necessarily limited to:

1. Coordination of the submittals.
2. Equipment unloading.
3. Furnishing, handling, storing, installing, starting-up, testing, demonstrating, and all other incidentals required to place the equipment into service.

1.02 REFERENCES

A. ASTM International (ASTM) Standards

1. A48 Standard Specification for Gray Iron Castings

B. Hydraulic Institute (HI) Standards

1. ANSI/HI 9.6.4 Rotodynamic Pumps for Vibration Measurements and Allowable Values

1.03 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Technical literature, bulletins, and/or catalog cuts of the equipment.
2. Performance curves.
3. Quality control test results.
4. Materials of construction.
5. Complete installation instructions, including electrical and mechanical requirements.
6. Operations and Maintenance Manuals.

B. Pump Manufacturer's recommendation of wet well filleting and extent of flat area as shown on the Drawings.

1.04 WARRANTY

A. The pump manufacturer shall warrant the pumps, pump parts, engine, and on-board control panels free from defects in workmanship or material under normal use and service for a period of two (2) years from date of startup.

B. Pump manufacturer warranties shall be in published form and shall apply to all similar units.

1.05 QUALITY CONTROL

A. Perform equipment tests in accordance with the Hydraulic Institute's - Submersible Pumps for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Tests.

1. Tests shall be performed on the actual assembled pumps to be supplied; prototype model tests are not acceptable.
2. Tests shall cover a range from shut-off to a minimum 20 percent beyond specified design capacity.
3. Factory test shall meet performance test level HI Grade 14.6, Level 1U.
4. Pump shall be vibration tested in conformance with ANSI/HI 9.6.4.

B. Conduct test per above specifications on all supplied pumps, generating a curve showing actual flow, head, BHP, and hydraulic efficiency.

C. MANUFACTURER QUALIFICATIONS: A qualified manufacturer. Maintain, within 100 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

D. SOURCE LIMITATIONS: Obtain packaged pump system and auxiliary components through one source from a single manufacturer.

E. 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.

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. ENGINE EXHAUST EMISSIONS: Comply with applicable state and local government requirements.

J. NOISE EMISSION: Overall sound dB(A) must be 90 or less at 7 meters for un-housed engine.

1.06 PROJECT CONDITIONS

A. ENVIRONMENTAL CONDITIONS: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.
2. Altitude: Sea level to 1000 feet (300 m).

1.07 COORDINATION

Coordinate size and location of concrete bases for package engine pump. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.08 MAINTENANCE SERVICE

A. INITIAL MAINTENANCE SERVICE

1. Beginning at Substantial Completion, provide 12 months full maintenance by skilled employees of manufacturer's designated service organization.
2. Include quarterly exercising to check for proper starting and running under load.
3. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation.
4. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
5. Service shall include complete system inspection and functional review of critical components, inspection of battery system, fuel system, engine system, engine lubrication system, intake/exhaust system, controls, and power connections.

PART 2 : PRODUCTS

A. Subject to conformance with the Contract Documents, the following manufacturers are acceptable:

1. Godwin CD150S Dri-Prime Pump.
2. Accepted Equal.

B. PERFORMANCE AND CONDITIONS OF SERVICE: The pump shall operate over the range of flows and heads specified below. Motor horsepower shall not exceed the values specified, and the hydraulic efficiency shall be equal to or higher than those listed.

Backup Diesel Pumps – Pump Station 19	
Number of Pumps	1
Design Point – One Pump Operation (gpm/ft)	1,440/96
Minimum Hydraulic Efficiency	60%
Max. Engine Motor Horsepower (HP)	62
Max. Speed (RPM)	2,000
Variable Speed	Yes
Min. Nominal Discharge Diameter (in)	6
Impeller Type	Cas Steel, non-clog
Material Pumped	Raw Municipal Sewage

C. The total heads specified herein do not include internal pump losses.

D. Pump shall operate without cavitation or vibration within the manufacturer's allowable operating range.

2.02 PUMP DESIGN

The pump shall be a diesel-powered backup pump capable of pumping raw domestic sewage in the event of pump station failure and shall be fitted with a fully automatic priming system capable of repeated priming from a completely dry pump casing.

2.03 PUMP CONSTRUCTION

A. Provide pump fabricated of the following materials:

Pump Components	**Material**
Pump Case	Cast Iron
Motor Housing	Cast Iron, ASTM A48, Class 35B
Impeller	Cast Chromium Steel or CA6NM Stainless Steel
Wear Plates	Cast Iron BS1561:1997
Pump Shaft	Carbon Steel BS970:1991 817M40T
Pump Gaskets	Compressed non-asbestos fiber, Teflon, or Viton-N
Pump Suction and Discharge Flanges	Cast Iron, ANSI B16.1 Class 150
O-Rings	Buna-N or Viton-N
Engine	EPA Tier 4 Compliant
Power/Control Cable Jacket	Chlorinated Polyethylene Rubber

B. Furnish pump case, impeller, intermediate housing, and motor housing with smooth surfaces devoid of blow holes and other irregularities.

C. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory-applied polyamidoamine epoxy protective spray coating on the exterior of the pump.

D. Sealing design shall incorporate metal-to-metal contact between machine surfaces.

E. All major castings shall be produced in the manufacturer's own foundry, under the manufacturer's direct supervision.

2.04 COMPONENTS

A. GENERAL

1. Provide pumps capable of handling solids, fibrous materials, sludge and other matter found in raw, unscreened municipal wastewater. Pump shall also be capable of continuous operation in a dry condition.

B. IMPELLER

1. The pump impeller shall be non-clog type, either open or fully enclosed.
2. The impeller shall be capable of handling a minimum of 2-9/16 inch solids.

C. BEARINGS

1. Bearings shall be of adequate size to withstand imposed loads and up to 100 psi of suction pressure.
2. Minimum B10 bearing life of 50,000 hours.

D. SEALS

1. Seals shall be high pressure, capable of withstanding suction pressures to 100 psi.
2. Acceptable seal configurations include:
   a. A single mechanical seal arrangement designed to incorporate a dished style back plate. The mechanical seal is to be of a run-dry design with an oil-filled enclosed style bracket for seal lubrication. The mechanical seal faces are to be silicon carbide rotating and tungsten carbide stationary.
   b. A double mechanical seal arrangement designed to meet API Standards. The inboard mechanical seal shall be a mechanical self-adjusting type with both interfaces of reaction bonded solid silicon carbide. The outboard mechanical seal shall also be a mechanical self-adjusting type with reaction bonded solid silicon carbide and carbon interfaces. The mechanical seal shall be cooled and lubricated in its own cooling reservoir, requiring no maintenance or adjustment.

E. DRIVE UNIT

1. The engine shall be a Tier 4 EPA compliant diesel engine, either water-cooled or air-cooled.
2. The electric engine starting system shall be at least 12 volts.

F. EXHAUST

1. Exhaust system must include a muffler of suitable size.

G. PRIMING SYSTEM

1. Pump shall be fitted with a fully automatic priming system. The following priming systems are acceptable:
   a. Gear driven twin-cylinder compressor and air ejector assembly lubricated and cooled from the engine.
   b. Mechanically driven, diaphragm style vacuum pump that requires no cooling liquid for operation of unit.
2. The pump must be capable of running totally dry, then re-priming and returning to normal pumping volumes. Pump and priming system shall be capable of priming the pump from a completely dry pump casing.
3. Equipment acceptance shall be contingent upon the pump's ability to run continuously at full speed in a completely dry condition.

H. SKID BASE

1. Maintain alignment of mounted components without depending on concrete foundation.
2. Provide lifting attachments.
3. The pump base tank must be constructed in accordance with the following standards and codes:
   a. Flammable and Combustible Liquids Code, NFPA 30;
   b. The Standard for Installation and use of Stationary Combustible Engine and Gas Turbines, NFPA 37; and
   c. The Standard for Emergency and Standby Power Systems, NFPA 110.

2.05 ENGINE

A. FUEL: Diesel (Fuel Oil #2).

B. RATED ENGINE SPEED: 1800 rpm.

C. LUBRICATION SYSTEM: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.

2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.

3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. ENGINE FUEL SYSTEM

1. Diesel Fuel: Provide the following:

a. Fuel-Shutoff Solenoid Valve (coordinate voltage with battery).

b. Flexible Fuel Connector.

c. Fuel pump:

1) Minimum of 10 foot of net positive suction head at full fuel rate.

2) Powered from battery voltage.

E. ENGINE BLOCK HEATER: 208 volts, 60 hertz, 30 amperes or less. Wired to accessory terminal box and controlled by engine control panel to heat windings if generator is not in use and ambient falls below a setpoint temperature.

F. COOLING SYSTEM: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.

3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.

b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. MUFFLER/SILENCER: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. Sized to limit noise emissions of engine combustion exhaust to 90 decibels $dB_{(A)}$ at 23 feet from exhaust.

H. AIR-INTAKE FILTER: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. STARTING SYSTEM: 12-Volt or 24-volt electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Fuel Supply Anti-siphon Solenoid Valve: provide normally closed, powered to open fuel supply valve and provisions to control valve.

2.06 APPURTENANCES

A. Cables must be suitable for the application, sized in accordance with NEC requirements.

B. Provide cables for level sensing systems.

C. SPARE PARTS: Supply the following.

1. Basic Repair Kit (Mechanical seals, O-rings, Bearings, etc.) – 1 set
    a. Compressor Belt – 1 ea.
    b. Compressor Pipe – 1 ea.
    c. Filler Dipstick Plug – 1 ea.
    d. Ejector Nozzle O-Ring – 2 ea.
    e. Ejector Nozzle – 1 ea.
    f. Ejector Jet, Rear Wearplate Stud O-Ring – 2 ea.
    g. Ejector Jet – 1 ea.
    h. Ejector Ball – 1 ea.
    i. Dowty Washer – 8 ea.
    j. CD80M, DC 150S Gasket – 2 ea.
    k. CD 150S, NC 150S NRV Valve O-Ring – 1 ea.
    l. CD 150S, NC 150S NRV Ball – 1 ea.

m. CD150S, NC 150S Filter Screen – 1 ea.

n. CD 150S, NC 150S HS200 O-Ring – 2 ea.

2. Sleeve Assembly – 3 sets

3. Impeller and Insert Ring – 3 sets

4. Vacuum Compressor – 1 set

5. Diesel Engine Spare Parts – 1 set for each engine

a. Engine Filter Parts Kit

1) Oil Filter – 1 ea.

2) Pre-Fuel Filter – 1 ea.

3) Main Fuel Filter – 1 ea.

4) Air filter – 1 ea.

5) Compressor Air Cleaner Element – 1 ea.

b. Engine Cooling Belt – 1 ea.

D. BATTERY CHARGER: Current-limiting, automatic-equalizing, and float-charging type. Unit shall comply with UL 1236 and include the following features:

1. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

2. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.

3. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.

4. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.

5. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

6. Enclosure: NEMA 250, Type 1.

2.07 COATINGS

Factory coat pump in accordance with manufacturer's recommendations.

2.08 CONTROLS

A. Pump controls in accordance with Division 40 – Process Control System

B. Provide automatic level control system capable of sending the level within a Class I, Division 1 wet well. Level control system shall be Evoqua A1000i and in accordance with Section 40 72 43 - Pressure and Differential Pressure Type Level Meters.

1. Provide method to start the priming system, engage the pump, and modulate the pumping capacity so that the pump speed increases and decreases with increasing and decreasing wet well levels, respectively.
2. Provide alarm for high level condition.

C. Provide remote signaling capabilities through analog and discrete transmitters.

1. Provide a voltage-free, normally open dry-contact for each of the following conditions:
    a. High Level detected in backup diesel pump wet well
    b. Low Level detected in backup diesel pump wet well
    c. Pump Ready (powered and no fault)
    d. Pump Running
    e. Low fuel
    f. Engine Shutdown (Engine not in Auto/Hand or a Fault exists)
2. Provide analog output, 4-20 milliamps, for each of the following signals:
    a. 0-16 feet wet well level
3. Provide solenoid valve for use with the anti-siphon fuel line.
    a. Coordinate solenoid valve voltage with battery voltage.

D. Provide controls based upon level control system and discrete level transmitter.

1. Provide operator adjustable level set points:
    a. Pump Start Wet Well Level
    b. Vacuum Prime Start Level
    c. Pump Maximum Speed Level
    d. Pump Minimum Speed Level
    e. Pump Minimum Speed
    f. Pump Maximum Speed
    g. Pump Stop Wet Well Level

2. Normal operation: start the pump at or above the pump start level. Continue pumping until the wet well measures at or below the Pump Stop level.

    a. Vary engine speed in proportion to the wet well level between the Minimum Speed Level and Maximum Speed level. Operate pump at minimum speed when at or below the Minimum Speed Level. Operate pump at maximum speed when at or above the Maximum Speed Level.

E. ETHERNET DATA CONNECTION: Provide converter device to allow access from a computer-based SCADA monitoring package using over Ethernet, Category 5e or better copper cabling.

1. Locate device within the engine pump control panel enclosure.

2. A http web-page, served from the converter device, shall display current engine generator status including alarms, voltages, capacity and other information.

3. Provide bus communications interface capable of transmitting registers using Rockwell Automation Ethernet IP protocol to Allen-Bradley Compact Logix. A SCADA monitoring package, such as Kepware I/O Server, must be able to retrieve all engine alarms through Ethernet IP interface.

    a. Provide web interface for display of current engine status and control system.

    b. Provide IEEE 802.3 ethernet port (e.g., RJ-45 style 8 position, 8 conductor) for connection to local communications network.

        1) Engine speed (RPM)

        2) Oil Pressure (PSI)

        3) Vacuum priming system Running

        4) Wet well level (feet)

        5) Fuel pressure

PART 3 : EXECUTION

3.01 INSTALLATION

A. See Equipment General Provisions, Section 22 13 29 – Equipment General Provisions.

B. Install pump as shown on the Drawings and as recommended by the manufacturer.

C. Pumps shall be set plumb with no stresses on the pump discharge. Vibration of the complete pump assemblies shall be within the limits recommended by the applicable standards of the Hydraulic Institute.

3.02 START-UP AND TRAINING SERVICE

A. The equipment manufacturer shall furnish the services of a qualified factory-trained field service representative for at least two (2) days of site visits to inspect, check, service, adjust and make corrections to the installation. Additionally, after the pump has been completely installed and wired, the Contractor shall have the manufacturer do the following:

1. Check seal lubrication.
2. Check for proper rotation.
3. Check level control operation and sequence.
4. Complete field testing of the installed equipment to ensure it is operating correctly.

B. Service representative shall submit a written report certifying that the equipment has been properly installed and checked.

C. Field test the pump after installation to demonstrate satisfactory operation. See WSDOT Special Provisions Section 1-05.11 – Facility Startup, Testing and Training.

1. Furnish all labor, materials, tools, equipment, incidentals, and services for developing a sufficient supply of potable water for functional testing. No extra payment will be made for delivering or placing the water, or for the quantity used. Sufficient quantities of water shall be available to test the full range of the equipment.
2. Testing shall be done in the presence of the Engineer.
3. Furnish all labor, materials, tools equipment, instruments, and services necessary.
4. If the pump fails to meet the requirements, the pump will be modified, repaired, or replaced at the Contractor’s expense.
5. Upon completion of the testing, the contractor shall furnish a full tank of fuel for the backup diesel wastewater pump.

D. Instruct the Owner's personnel on the operation and maintenance of the pumping unit. This shall be deemed to be a separate one-day visit to the site, independent of visits required for equipment checkout, testing, and startup unless noted otherwise or prior concurrence of the Engineer and Owner are received.

3.03 CLEANING

A. All materials and equipment shall be new and, therefore, shall require only a minimum amount of routine cleaning during or after installation.

B. All debris, grit, petroleum products, rust scale, construction by-products, and foreign matter shall be removed, and damaged coatings shall be repaired prior to final acceptance. All cleaning regimen suggested by the manufacturer shall be done.

END OF SECTION

22 40 00
PLUMBING FIXTURES

PART 1 : GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and WSDOT Division 1 Specification Sections, apply to this Section.

1.02 REQUIRED SUBMITTAL DATA

A. PRODUCT DATA: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1. Shop Drawings: Diagram power, signal, and control wiring.

1.03 DESCRIPTION OF WORK

A. This Section includes the following conventional plumbing fixtures and related components:

1. Miscellaneous piping specialties including:

a. Hose bibbs.

1.04 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

1. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
2. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
3. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
4. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, showerheads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
5. FRP: Fiberglass-reinforced plastic.
6. PMMA: Polymethyl methacrylate (acrylic) plastic.
7. PVC: Polyvinylchloride plastic.
8. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.05 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. 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.

B. REGULATORY REQUIREMENTS

1. Comply with requirements in ICC/ANSI A117.1, “Accessible and Usable Buildings and Facilities” and “Americans with Disabilities Act” for plumbing fixtures for people with disabilities.
2. Comply with requirements in US Public Law 102-486, “Energy Policy Act,” for water flow and consumption rates for plumbing fixtures.
3. Comply with the requirements of the most recently adopted version of the Uniform Plumbing Code (IAPMO) and as amended by the Authority Having Jurisdiction.
    a. NSF Standard: Comply with NSF 61, “Drinking Water System Components – Health Effects,” for fixture materials that will be in contact with potable water.
    b. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
    c. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
        1) Hose-Coupling Threads: ASME B1.20.7.
        2) Hose Bibbs: ASME A112.18.1M

PART 2 : PRODUCTS

2.01 MISCELLANEOUS PIPING SPECIALTIES

HOSE BIBBS: Rough bronze body with removable key or wheel handle, ¾” threaded or solder-joint inlet, 125 psig, integral, non-removable, drainable hose-connection vacuum breaker; and garden-hose threads on outlet.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

3.03 CONNECTIONS

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.04 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

1. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
2. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
3. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
4. Report test results in writing.

3.05 CLEANING

Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

3.06 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

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SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Work includes complete mechanical systems indicated on the drawings and specified. The Bid and Contract Documents and General Requirements of the specification are a part of this division of the specification. Where the word “provide” is used, it means “furnish and install complete and ready for use.” Provide supervision, labor, material, equipment, and machinery necessary to complete the mechanical systems. Provide finished work, tested and ready for operation.

1.02 DRAWINGS

A. Drawings are diagrammatic, indicating the general arrangement of systems and work, and do not attempt to show exact details or all offsets in piping and ductwork. Do not scale drawings. Examine the architectural drawings for exact location of fixtures and equipment. Where they are not definitely located, obtain this information from the Engineer.

B. Follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom. If space conditions appear inadequate, notify the Engineer before proceeding with the work. Make reasonable modifications in the work without extra cost as needed to prevent conflict with work of other trades and for proper execution of the work.

1.03 EQUIPMENT DEVIATIONS

A. Specific manufacturers and model numbers are noted to indicate a standard of design and are not intended to be restrictive.

B. Where the term “or approved equal” is used, alternative and/or substitute products will be considered only prior to the bid date (Prior Approval). Where the term “or equal” is used, approval of alternative and/or substitute products may be requested by the contractor after the bid date. Submittal, review, and potential approval of alternative and/or substitute products will be considered and executed only under terms and conditions specified in Section 1-06.6, Substitution Procedures.

C. When submitting an alternative and/or substitute product, Contractor shall include complete product literature of original specified item.

D. Provide redesign to any part of the work resulting from the use of equipment and material other than specified or indicated on the drawings. Obtain approval of redesign from the Engineer. Redesign cost and additional construction cost resulting from the redesign shall be at the Contractor’s expense.

1.04 GENERAL REQUIREMENTS FOR SHOP DRAWING AND SUBMITTAL DATA

A. Submit in accordance with the provisions of the WSDOT Division 1 Special Provisions.

B. The submittal data for the material and equipment may be submitted at separate times as follows:

1. Control Drawings and Submittal Data – a minimum of four (4) weeks prior to installation.
2. All other Submittal Data – a minimum of four (4) weeks prior to purchase.

C. See individual specification sections for required submittal data.

1.05 REQUIRED SUBMITTAL DATA FOR THIS SPECIFICATION SECTION

None.

1.06 CODES AND STANDARDS

A. Give necessary notices, obtain permits, and pay taxes, fees, and other costs, including utility connections or extensions for the work. File necessary drawings, prepare documents, and obtain necessary approvals of governmental departments having jurisdiction. Include all costs associated with notices; permits; taxes; fees; utility connections or extensions; government approvals; and other related costs in original bid. Obtain required certificates of inspection for work and deliver to the Engineer before request for acceptance and final payment for the work.

B. Comply with laws, ordinances, rules, regulations, and lawful orders of any public authority bearing on the performance of the work. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, they shall promptly notify the Engineer in writing and any necessary changes shall be accomplished by appropriate modification. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules, and regulations, and without notice to the Engineer, they shall assume full responsibility, and shall bear all costs.

C. Material and equipment within the scope of the UL Testing Laboratory Service shall be listed by the Underwriters Laboratories for the purpose for which they are used and shall bear their listing mark.

PART 2 : PRODUCT

Not Used.

PART 3 : EXECUTION

3.01 COOPERATION WITH OTHER TRADES

A. Give full cooperation to other trades and furnish in writing to other trades, with copies to the Engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Where mechanical work will be installed in close proximity to, or will interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment. If work is installed before coordinating with other trades, or if it causes any interference with work of other trades, make the necessary changes in the work to correct the conditions and bear all costs.

C. Furnish to other trades necessary templates, patterns, setting drawings and shop details for the proper installation of work and for coordinating adjacent work.

3.02 SAFETY

The Engineer has not been retained to provide design and construction services relation to the Contractor's safety precautions, or to means, methods, techniques, sequences, or procedures required for the Contractor to perform his work. The Contractor is solely and completely responsible for conditions of the job site, including safety of persons and property during performance of work. This requirement applies continuously and is not limited to normal working hours. Comply with "Safety and Health Regulations for Construction," Volume 36, No. 75, Part II of the Federal Register by the US Department of Labor. Provide required safety measures and consult with the state or federal safety inspector for interpretation whenever in doubt as to whether safe conditions do or do not exist or whether compliance with state or federal regulations exists.

3.03 PROTECTION

A. Protect work and material from damage and be liable for damage.

B. Be responsible for work and equipment until finally inspected, tested, and accepted; protect work against theft, injury, or damage; and carefully store material and equipment received on site which are not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of obstructing material.

3.04 MATERIAL AND WORKMANSHIP

A. Materials and equipment required for the work shall be new and shall be furnished, delivered, erected, installed, connected, and finished in every detail; and shall be selected and arranged to fit properly into the building spaces. Where no specific kind or quality of material is given, an article as approved by the Engineer shall be provided.

B. Furnish the services of an experienced superintendent, who shall be constantly in charge of the work.

C. Equipment and materials shall be installed with the approval of the Engineer in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

D. Provide equipment in the mid- range of written performance documentation to allow for adjustment.

3.05 ACCESSIBILITY

A. Install the work with adequate clearances throughout the project, including being responsible for the sufficiency of the size of shafts, chases, double partitions, and suspended ceilings. Cooperate with other trades where work is in the same space. Such spaces and clearances shall be kept to the minimum size required.

B. Locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Minor deviations from drawings may be made to allow for better accessibility and any change shall be approved by the Engineer.

C. The Mechanical Subcontractor shall provide the General Contractor the exact locations of access panels for each concealed valve, control damper or other device requiring service. Access panels will be provided and installed by the General Contractor and as specified in the other divisions of the specifications. Submit locations of these panels to the General Contractor in sufficient time to be installed in the normal course of work.

3.06 ELECTRICAL CONNECTIONS

A. The Electrical Subcontractor shall provide wiring, except temperature control wiring, equipment control wiring, and interlock wiring. The Electrical Subcontractor shall provide power wiring complete from power source to motor or equipment junction box, including power wiring through starters. Electrical Subcontractor shall provide starters and disconnect switches not factory-mounted on equipment.

B. The Mechanical Subcontractor shall, regardless of voltage, provide temperature control wiring, interlock wiring, and equipment control wiring for the equipment that the Mechanical Subcontractor furnishes or installs.

C. The Electrical Subcontractor shall be responsible for power wiring. Control wiring shall be the responsibility of the Mechanical Subcontractor. Motors and equipment shall be provided for current characteristics as indicated on the electrical drawings.

3.07 CUTTING AND PATCHING

A. Provide drilling, coring, cutting, and patching necessary to install the work specified in this division. Patching shall match adjacent surfaces.

B. No structural members shall be cut without the approval of the Engineer and cutting shall be done in a manner directed by them. Do not damage or endanger any portion of the project or work of the Owner or any other separate contractor by drilling, coring, cutting, patching, excavating, and backfilling.

C. Inform the General Contractor and other subcontractors affected of requirements for cutting and patching.

3.08 OPERATING INSTRUCTIONS

A. Upon completion of the work, furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of three (3) days of eight (8) hours each, or as otherwise specified. Give at least forty-eight (48) hours' notice to the Owner in advance of this period. During this period, instruct the Owner or his representative fully in the operation, adjustment, and maintenance of all equipment furnished. The training of the appropriate maintenance staff for each equipment type and/or system shall include, as a minimum, the following:

1. System/Equipment overview (what it is, what it does and which other systems and/or equipment does it interface with).
2. Review of the available O&M materials.
3. Review of the Record Drawings on the subject system/equipment.
4. Hands-on demonstration of all normal maintenance procedures, normal operating modes, and all emergency shutdown and startup procedures.

3.09 MECHANICAL EQUIPMENT MANUALS

A. Upon completion of the work and prior to acceptance of the mechanical work, prepare servicing manuals in accordance with industry-accepted standards describing the requirements of mechanical equipment provided under this division of the specification.

B. Refer to Section 1-11 of the WSDOT Division 1 Special Provisions for equipment manual requirements.

C. Data in manuals shall be neat, clean copies. Drawings shall be accordion-folded. Manufacturers' advertising literature or catalogs will not be acceptable for operating and maintenance instruction.

3.10 RECORD DRAWINGS

Within 90 days after the date of system acceptance, provide record drawings of all buildings and plot plans. Record drawings shall include as a minimum the location and performance data on each piece of equipment, general configuration of duct and pipe distribution system, including sizes, and the terminal air and water design flow rates of the actual installation. Record drawings shall also incorporate any mechanical work which deviates from the contract drawings, including changes resulting from addenda, Requests for Information, and Change Orders. Neatly draft changes on clean "hard copy" drawings to show the work clearly in the actual locations as built.

3.11 CLEANING

A. Promptly remove waste material and rubbish caused by the work. At Completion of the work, clean the dirt and debris from the mechanical installation, including equipment, piping, ductwork, and plumbing fixtures.

B. Upon completion of the project and after cleaning is complete and before project is air balanced, provide clean air filters throughout.

3.12 WARRANTY

A. All work, materials, and equipment to be free from defects. Correct all defects and failures occurring within one year from date of substantial completion without cost to the Owner except when such failure is due to neglect or carelessness by the Owner, as determined by the Engineer.

B. The warranty disregards shorter time limits by any manufacturer of equipment provided.

C. Make all necessary adjustments and corrections during first year of operation. The fact that the Engineer was present during any construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Seismic protection of equipment.

1.02 REQUIRED SUBMITTAL DATA

None.

1.03 STANDARDS AND CODES

A. SMACNA publication “Seismic Restraint Manual – Guidelines for Mechanical Systems” for seismic protection of piping.

B. The International Building Code for seismic protection of equipment.

1.04 RELATED WORK

A. All portions of WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00 apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

A. PIPE HANGERS AND SUPPORTS

1. Anvil, Erico, Grabler, Fee & Mason, Unistrut, Superstrut, or equal.

2.02 MATERIALS

All hangers, supports, and hardware shall be hot-dipped galvanized or stainless steel unless noted otherwise on Drawings. All anchors shall be 316 stainless steel.

2.03 STRUCTURAL ATTACHMENTS

A. CAST-IN-PLACE WALL INSERTS

1. Unistrut P-3200 series inserts for concrete walls.
2. Unistrut P-1000 channels with P-1045 and P-1047 fittings for frame and block walls.

B. Attachment into existing concrete or masonry wall: Self-drill type Red Head, Phillips Anchors, or equal. Do not use power-driven inserts.

2.04 INTERMEDIATE ATTACHMENTS

A. HANGER RODS

1. Continuous threaded steel rod; do not use chain, wire, or perforated strap.
2. Maximum hanger rod loading as follows:

Rod Size, Diameter in Inches	Maximum Load, Pounds
⅜	610
½	1,130
⅝	1,810
¾	2,710
⅞	3,770
1	4,960

B. HANGER STRAPS: Galvanized bar steel; ¾-inch wide by 18 gauge for 2½-inch and smaller pipe; ⅞-inch wide by 16 gauge for 3-inch to 4-inch pipe; 1⅛-inch wide by 12 gauge for 6-inch pipe size.

2.05 PIPE ATTACHMENTS

A. PIPE RINGS

1. Steel pipe and cast-iron soil pipe: 2-inch and smaller, adjustable ring Anvil #69. 2½-inch and larger, adjustable clevis Anvil #260.
2. Copper Pipe: 2-inch and smaller pipe, use adjustable ring Anvil #CT-69; for pipe 2½-inch and larger, use adjustable clevis Anvil #CT-65.
3. Finish: Copper-plated where ring encounters copper pipe; galvanized for contact with galvanized steel pipe; black for all other applications.
4. Application: Use only on piping systems where axial movement from thermal expansion is less than ½-inch.
5. For Hanger Straps: Elcen Figure 94 or Anvil Figure 97 with flattened-end bolt through cast iron socket; or hinged type, Modern Hanger Corporation No. 20, Elcen Figure 104, or Anvil Figure 108. Pipe rings shall be electro-galvanized, prime painted, or cadmium-plated.

B. PIPE CLAMPS

1. Vertical piping: Unistrut P-1332 shelf bracket, Unistrut P-1100 channel, and Unistrut P-1100 series pipe clamps. Copper pipe clamps for copper pipe.
2. Horizontal racked piping: Unistrut P-1109 series or Unistrut P-2024C series clamps for Unistrut channel pipe racks.
3. Application: Use on piping systems without any thermal expansion.

PART 3 : EXECUTION

3.01 HANGER SPACING FOR PIPING

A. HORIZONTAL STEEL PIPE: Maximum hanger spacing and minimum hanger rod diameters as follows:

Pipe Size	Span	Rod Size
½ and ¾-inch pipe	5-foot span	⅜-inch rod
1 and 1¼-inch pipe	7-foot span	⅜-inch rod
1½-inch pipe	9-foot span	⅜-inch rod
2-inch pipe	10-foot span	⅜-inch rod
2½and 3-inch pipe	12-foot span	½-inch rod
4-inch pipe	14-foot span	⅝-inch rod
6-inch pipe	17-foot span	¾-inch rod

B. HORIZONTAL COPPER PIPE: Maximum hanger spacing and minimum hanger rod diameters as follows:

Pipe Size	Span	Rod Size
½-inch pipe	5-foot span	⅜-inch rod
1-inch pipe	6-foot span	⅜-inch rod
1¼ and 1½-inch	6-foot span	⅜-inch rod

C. Provide additional hangers or supports at concentrated loads such as valves, to maintain alignment and prevent sagging.

D. Piping crossing over excavated and backfilled areas, provide precast concrete beam supported by the building structure and undisturbed earth.

3.02 INSTALLATION OF PIPE HANGERS AND SUPPORTS

A. Provide piping supports and hangers with a means of adjustment for leveling, grading of piping and cold spring movements.

B. Provide sufficient hanger rod lengths to limit rod displacement from thermal expansion to 4 degrees from vertical.

C. Size pipe rings and clamps to pass around the pipe, except on piping with a vapor barrier on the insulation, then size rings and clamps to pass around the outside of the insulation utilizing insulation protection shields Anvil Fig. 167. Provide rigid inserts as required to prevent crushing of insulation.

D. Install vertical piping supports to allow for pipe movement due to thermal expansion and contraction.

E. Do not support any pipe from any other pipe.

F. Install steel backing in walls as required to support piping hung from steel stud walls.

G. Embed concrete inserts in new cast-in-place concrete. With concrete joist framing, place inserts at bottom of joists wherever possible. If closely spaced steel prevents such placement, provide Parker Kalon Type U-Drive screws, and attach to sheet metal pan forms.

H. Provide bored, drilled, or reamed holes for all bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched, or hand-sawn holes will not be accepted.

I. Install anchor bolts for all mechanical equipment and piping as required. Tightly fit and clamp base-supported equipment anchor bolts at all equipment support points. Provide locknuts where equipment is hung.

3.03 SEISMIC PROTECTION OF EQUIPMENT

Provide seismic protection for all equipment in accordance with seismic and wind restraint design as detailed in ASHRAE Handbook, *HVAC Applications*.

END OF SECTION

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Mechanical Equipment Isolators.

B. Flexible Pipe Connectors.

C. Equipment Seismic Anchorage.

1.02 REQUIRED SUBMITTAL DATA

A. Mechanical Equipment Isolators.

B. Submittals shall include for each piece of equipment isolated and seismically protected:

1. Load diagrams.
2. Seismic anchorage calculations and details.
3. Types and locations of base and each isolator.

1.03 CODES AND STANDARDS

A. *ASHRAE Handbook: HVAC Applications*, latest version.

B. IBC 2012 Section 1613.

C. ASCE 7-10 Chapter 13.

1.04 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00 apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCT

2.01 MANUFACTURERS

Kinetics Peabody Noise Control, Mason Industries, Amber-Booth, Vibrex, Flexonics, or equal.

2.02 MECHANICAL EQUIPMENT VIBRATION ISOLATORS

Spring hanger Kinetics SFH.

PART 3 : EXECUTION

3.01 EQUIPMENT

A. SPRING ISOLATORS

1. Provide spring isolation for muffler.

END OF SECTION

SECTION 23 05 53
PAINTING AND IDENTIFICATION FOR HVAC PIPING, DUCTS, AND EQUIPMENT

PART 1 : GENERAL

1.01 WORK INCLUDED

Mechanical systems painting.

1.02 REQUIRED SUBMITTAL DATA

None.

1.03 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00 apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

1.04 DEFINITIONS

A. “Concealed” work is defined as work installed within pipe shafts, duct spaces, above furred or hung ceilings, or otherwise built into the building and not exposed to view.

B. “Exposed” work is defined as work in walkway tunnels, Mechanical and Fan Rooms, exterior to building (including rooftops), all occupied areas and all other areas not defined as “concealed.”

1.05 MANUFACTURERS

GENERAL: Acceptable manufacturers are Quigley; Cowman and Campbell; Fuller; General Paint; Sherwin-Williams; Glidden; or equal.

PART 2 : PRODUCTS

2.01 PAINT

A. Paint all exposed mechanical work, including ducting, piping, and insulated surfaces. Undamaged factory-finished equipment need not be repainted. Color of paint shall be a standard manufacturer’s color as selected by Project Representative.

B. Repaint damaged factory-finished equipment.

C. Paint all visible surfaces behind grilles dull black.

D. Use skilled painters; paints, well mixed; each coat to have slight variation in color from the preceding, for ready identification.

E. Clean grease, dirt, wax, and scale from surfaces before painting.

F. CLEANING SOLVENTS: Mineral Spirits; remove cleaning solvent cloths from building each day.

G. METAL SURFACES

1. In General: 3 mils minimum dry film thickness; apply one (1) priming coat and one (1) finish coat of acrylic base paint and additional coats as required to obtain minimum dry film thickness.
2. High Temperature Surfaces (Steam and Hot Water Heating Equipment): 3 mils minimum thickness; apply one (1) prime coat and one (1) finish coat of heat-resistant paint and additional coats as required to obtain minimum dry film thickness.
3. Outside Building: 4 mils minimum thickness; apply prime coat and two (2) finish coats of acrylic base paint and additional coats as required to obtain minimum dry film thickness.

H. INSULATION SURFACES: 3 mils minimum dry film thickness; apply one (1) coat of primer-sealer, and one (1) coat of acrylic base paint and additional coats as required to obtain minimum dry film thickness.

I. Grilles: 3 mils minimum thickness; apply spray paint; one (1) primer coat and two (2) coats of industrial enamel.

J. Heat Resistant Paint: Quigley AAA high temperature paint.

PART 3 : EXECUTION

3.01 PAINTING

A. Identify and provide flow direction arrows on all piping and equipment only in Mechanical room and fuel tank canopy.

B. Apply piping identification bands and flow arrows on 10-foot centers in general, 20-foot centers in open areas where pipe is exposed, and wherever a pipe leaves or enters any wall, floor, ceiling, or foundation. Place the proper band on pipe at each valve, branch connection, manifold, entrance, and exit from a tank, vessel, or piece of equipment. Apply after paint work is completed.

C. Label each piece of mechanical equipment and system with equipment or system name lettered thereon with 2-inch-high block style black paint letters.

D. Provide tag on each valve. Tag shall be provided with an identifying number. Post a plastic-laminated Valve Index where directed by Engineer. Index shall identify location, service, and identification number of each tagged valve.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 : GENERAL

1.01 WORK INCLUDED

A. Air systems balancing.

B. Balancing reports.

1.02 REQUIRED SUBMITTAL DATA

A. Proposed systems balancing contractor name and certification.

B. Balancing agenda.

1.03 SYSTEMS BALANCING CONTRACTOR

A. Systems balancing contractor shall be qualified to perform the testing and balancing work as indicated on the drawings and specified herein. Qualifications include:

1. A minimum five (5) years' experience record in systems balancing of projects of similar scope and complexity, and
2. Contractor shall be independent of the installing contractors or equipment suppliers for this project.

B. Qualified systems balancing contractors: Neudorfer Engineers, AirTest Inc., United Test & Balance, TAC Systems, Hardin and Sons, or approved equal.

C. To be considered for consideration as an approved equal, company shall submit a list of recent past similar projects including a description of the size and scope of the project, name of the principal technician and references including current phone numbers; and maintain association with AABC or NEBB as follows:

1. Membership in the AABC, or
2. Certification by the NEBB.

D. Within 60 days after contract award, submit the name of the proposed systems balancing contractor along with the name of the principal technician along with past similar projects including a description of the size and scope of the project.

1.04 COORDINATION WITH COMMISSIONING

Upon completion of the work, provide the necessary skilled labor, helpers, materials, and equipment to support the commissioning work. During the commissioning, coordinate with the commissioning company and make all adjustments required to demonstrate systems are working properly.

1.05 CODES AND STANDARDS

A. Washington State Energy Code Commercial Provisions, latest adopted version.

B. NEBB Procedural Standards for Testing Adjusting and Balancing of Environmental Systems (PSTABES).

1.06 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00 apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCT

2.01 BALANCING REPORT

A. When requested, provide a preliminary balancing report to the mechanical or General Contractor to indicate to the building inspector that balancing is in progress.

B. When balancing is nearly complete, provide a “95% complete” balancing report for the review by the Engineer. When acceptable to the Engineer, provide an electronic version of the report in PDF format.

C. Provide three (3) sets of final balancing reports incorporating comments made on the preliminary report, two (2) for the Owner and one (1) for the Engineer. Alternately, when acceptable to the Engineer, provide an electronic version of the report in PDF format.

D. Include in report: Project Name, Owner, Engineer, Systems Balancing Subcontractor, other data necessary to describe activity, and the status of the systems plus the following data:

1. DX Split System:
    a. Installation data:
        1) Manufacturer and model
        2) Size
        3) Arrangement, discharge, and class
        4) Motor horsepower (HP), voltage, phase, Hertz (Hz), and full load amperages (amps)
        5) Identification data
        6) Type of Service
    b. Design data:
        1) Total CFM
        2) Unit inlet, unit outlet and fan total static pressures

3) Motor HP, rpm, and amp

4) Fan rpm

5) Fan BHP

c. Fan recorded data:

1) Total CFM

2) Static pressure (suction, discharge, and total)

3) Fan rpm

4) Fan motor rpm

5) Fan motor rated voltage and amperage

6) Fan motor operating voltage and amperage

7) Motor calculated BHP

8) Drive sizes (sheaves, belts, and shaft)

9) Serial number

PART 3 : EXECUTION

3.01 PROCEDURES

Obtain confirmation from mechanical contractor that systems to be balanced are complete and functioning per design intent prior to commencing balancing.

3.02 INSTRUMENTS

Use accurate and recently calibrated instruments. Provide instrument calibration history if requested by the Engineer.

3.03 BALANCING AGENDA

Submit balancing agenda prior to start of work. Include the following in the agenda:

1. A complete listing of all flow (air and water) and air terminal measurements to be performed.

3.04 GENERAL PROCEDURES

Perform testing, adjusting, and balancing (TAB) in accordance with the procedural standards of the organization certifying the TAB firm and generally accepted engineering standards.

END OF SECTION

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SECTION 23 07 00
HVAC INSULATION

PART 1 : GENERAL

1.01 WORK INCLUDED

Pipe insulation.

1.02 REQUIRED SUBMITTAL DATA

Generator pipe insulation.

1.03 CODES AND STANDARDS

A. GENERAL

1. NFPA 90A – Installation of Air Conditioning and Ventilating System.
2. NFPA 90B – Standard for the Installation of Warm Air Heating and Air-Conditioning System.
3. UL 181 (Class 1) – Factory-Made Air Ducts and Connectors.
4. UL 723 – Tests for Surface Burning Characteristics of Building Materials.
5. ASTM E2336 – Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
6. ASTM C534 – Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
7. Washington State Energy Code Commercial Provisions, latest adopted version.
8. MIL-A-24179A – Adhesive, Flexible Unicellular-Plastic Thermal Insulation.

B. FOR ELASTOMERIC MATERIAL

1. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

C. FOR FLAME SPREAD AND FUEL-CONTRIBUTED AND SMOKE

1. UL 723 – Tests for Surface Burning Characteristics of Building Materials.
2. NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials.
3. ASTM E84.

D. RED LIST

1. Materials as defined by the Living Building Challenge Rating System known to have a hazardous effect on human health.

1.04 DEFINITIONS

A. "Conditioned space" is defined as a cooled space, heated space (fully heated), heated space (semi-heated), or indirectly conditioned space.

1.05 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00 apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCT

2.01 GENERAL

A. Materials shall be of the highest grade. Adhesives, sealers, vapor coatings, etc., shall be compatible with the materials to which they are applied; shall not corrode, soften, or otherwise attack such material in either the wet or dry state; and shall not emit volatile organic compounds (VOCs). Scrap pieces of insulation shall not be used where a full section will fit. Glass fiber materials which become wet or damaged during installation shall be removed and replaced with new materials. Acceptability of a manufacturer is not to be taken as acceptability of its "usual" or "regular" accessory materials such as facings, adhesives, etc.

B. Unless specified otherwise, all facings, coatings, PVC covers, and other accessories shall have a fire hazard rating not to exceed 25 for Flame Spread and 50 for Fuel Contributed and Smoke Developed; ratings determined by UL 723, NFPA 255, or ASTM E84. Grease duct insulation and enclosure shall meet the requirements of ASTM E2336. UL label or listing, or satisfactory test results from the approved testing laboratory, shall be available to indicate that fire hazard ratings for materials do not exceed the above amounts.

C. Product used shall emit no VOCs when applied, and shall not contain phenol, formaldehyde, or acrylics.

D. Product used shall not contain Red List Materials.

E. Insulation shall comply with the latest adopted version of the Washington State Energy Code Commercial Provisions.

2.02 ACCEPTABLE MANUFACTURERS

A. Product name and numbers listed are Owens-Corning Fiberglas, Armstrong Cork Company, and Childers.

B. Other acceptable manufacturers are Manville, Certain-Teed, Knauf, or equal.

2.03 PIPING INSULATION MATERIALS

A. Provide insulation material and cover as follows. Provide metal jacketing as indicated in paragraph 2.05 “PIPE AND DUCT METAL JACKETING” below:

Service	Insulation Material	Insulation Cover	Jacketing
Refrigerating Piping	Armstrong II/Armaflex flexible closed-cell elastomeric unslit tubing.	Seam joint adhesive Armstrong Adhesive #520, insulation coating WB Armstrong Armaflex Finish	See paragraph 2.05 “PIPE METAL JACKETING” below
Miscellaneous: Refrigeration Condensate Drain Piping	Two-Piece Fiberglas ASJ/SSL-II	Fiberglas ASJ/SSL-II, or at contractor’s option Armstrong ½-inch thick self-seal Armaflex 2000 on piping ½-inch thru 2-inch pipe size	See paragraph 2.05 “PIPE METAL JACKETING” below

2.04 PIPING INSULATION THICKNESS

A. All domestic cold-water piping, including all piping installed in concealed spaces, shall be insulated per the following table, and in accordance with all requirements of the Washington State Plumbing Code, and shall be sealed vapor-tight to prevent condensation from forming on the pipe or insulation.

B. Insulate all piping with the materials specified in the preceding table to the thicknesses required in the Washington State Energy Code Commercial Provisions, and in accordance with the following table, except:

1. Piping installed within unitary HVAC equipment need not be insulated.
2. Specified insulation that has a conductivity outside the range indicated in the following table shall be provided with the minimum thickness required in the “Alternative Insulation Types” portion of the Washington State Energy Code Commercial Provisions.

Design Operating Temperature Range (°F)	Insulation Conductivity		Nominal Pipe Diameter (Inches)				
	Conductivity Range (BTU-in/ (h-ft^2-°F)	Mean Rating Temperature (°F)	<1	1 to <1½	1½ to <4	4 to <8	>8
Cooling and Refrigerant Systems							
40-60	0.22-0.28	100	0.5	0.5	1.0	1.0	1.0
Below 40	0.22-0.28	100	0.5	1.0	1.0	1.0	1.5
Miscellaneous Systems							
All	0.22-0.28	100	1.0	1.5	1.5	1.5	2.0

2.05 PIPE METAL JACKETING

A. INDOORS

1. Childers Strap-On aluminum jacket, 0.016-inch minimum thickness and ½-inch wide aluminum bands, 0.02-inch minimum thickness for pipe and ducts.
2. Childers aluminum jacket, 0.02-inch minimum thickness for pipefittings.

B. OUTDOORS

1. Piping, fittings, valves, and accessories, and ductwork shall be insulated and jacketed with a durable, thermal, and impermeable jacketing. At Contractor's option, this may be a single layer of insulated jacketing that meets the insulation requirements in the table above or may be a combination of an inner insulation covered by a layer of insulated jacketing.
2. The insulated jacketing shall be puncture-resistant metal cladding, maintenance-free white metal surface not needing painting in the future with zero permeability. Insulated jacketing shall be ArmaTuff as manufactured by Armacell LLC or approved equal.
3. Should an inner insulation layer be required, it shall be a single layer with 50% overlap. The insulation shall be flexible elastomeric, closed-cell material to of a thickness to meet the insulation requirements in the table above when combined with the insulated jacketing. Insulation shall comply with ASTM C534, Type II for sheet materials. Field-applied adhesive shall comply with MIL-A-24179A, Type II, Class 1. Insulation shall be ArmaFlex as manufactured by Armacell LLC or approved equal.

2.06 GENERATOR AND DIESEL PUMP EXHAUST INSULATION

A. Hydrous Calcium Silicate Insulation for Equipment and Exhaust.

1. Insulation: Manville "Thermo-12 Gold Calcium Silicate" or accepted equal; asbestos free; premolded, thickness as listed in paragraph 3.04.
2. Field applied jackets: Stainless steel jacket shall be 0.010" Type 304 sheet with smooth finish and with factory applied moisture barrier.
3. Bands: Type 304 stainless steel.
4. Accessory materials shall be installed in accordance with manufacturer's instructions and in conformance with the current edition of Commercial and Industrial Insulation Standards or other recognized standards.

2.07 RIGID INSERTS

A. Manville Thermo-12 pipe insulation, cork, or shaped wood.

PART 3 : EXECUTION

3.01 PREPARATION

A. Install covering after piping, ductwork, and equipment have been tested and approved.

B. Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application.

C. Ensure insulation is continuous through inside walls except at firewalls.

D. Deliver material to job site in original non-broken factory packaging, with manufacturer's labels.

E. Perform work at ambient and equivalent temperatures as recommended by the manufacturer.

3.02 PIPING

A. Apply insulation to connections, joints, welds, flanges, or threaded joints after pipe tests are completed.

B. Apply insulation over flanged joints after piping has been brought up to operating temperature and flange bolts have been fully tightened.

C. Provide rigid inserts where piping supports pass around the outside of insulation with a vapor barrier. Repair damage to vapor barrier resulting from installation of the inserts by sealing with a vapor barrier pressure-sensitive tape.

D. Finish insulation neatly at hangers, supports and other protrusions.

E. Provide adequate support for insulation on vertical pipe to prevent slipping.

F. Insulate refrigeration liquid piping in the building, and refrigeration suction piping in the building and outside the building. Apply insulation coating on refrigeration piping insulation outside the building not covered with metal jacket. Do not insulate hot gas pipe.

G. Seal butt joints of insulation with pressure sensitive vapor barrier tape. Seal exposed ends of insulation with Benjamin-Foster 30-36, and at 21-foot intervals on continuous runs of pipe. Use Armstrong #520 adhesive on Armaflex II and Armstrong 2000 products. Apply insulation with all sides and end joints butted tightly.

H. VALVES, FITTINGS, AND ACCESSORIES

1. Except as specified otherwise, insulate with covering same as pipe insulation material or equal in temperature resistance and thickness to that of connecting pipe.
2. Fittings, valves, and accessories exposed in rooms cover with Zeston PVC covers, installed in accordance with the manufacturer's directions.

I. CALCIUM SILICATE INSULATION

1. Wire in place with 16-gauge black annealed wire, 12-inches on center. Stagger joints on multi-layered applications.

2. Field apply jackets in accordance with manufacturer's directions.

3.03 PIPE METAL JACKETING

A. Cover piping, fittings accessories, and ductwork above the roof and elsewhere where exposed to weather with durable, thermal, and impermeable jacketing.

B. Cover insulated piping, fittings accessories in utility tunnels and where indicated on the drawings with metal jacketing.

C. All jacket joints to overlap 2-inch minimum. Provide corrosive-resistant straps at all joints and on 18-inch maximum centers with straps tightened to hold jacket tightly to insulation surfaces.

3.04 GENERATOR AND DIESEL PUMP EXHAUST INSULATION

A. APPLICATION

1. Hydrous Calcium Silicate Insulation: Insulate the following to the thickness listed:

Item	Minimum Thickness
Diesel Pump and Emergency Generator	4-inch

B. CALCIUM SILICATE INSULATION

1. Provide lugs, nuts, or 10-gauge black annealed iron wire welded to metal surfaces for securing insulation.

2. Fill depression and cavities in equipment surfaces with insulating cement to provide smooth base for insulation. Finish curved surface to conform to curve of surface being covered. Finish other surfaces true and smooth. Reinforce insulation at openings and corners with metal beading. Leave access doors, moving parts and code stamps uncovered. Install insulation around openings to assure accessibility.

3. Secure block insulation with ½-inch wide stainless steel bands spaced at maximum 18-inch centers except where block insulation is reduced in dimension. Space bands as required. Fasten to lugs, nuts or to wires welded to shells.

4. Cover entire area of insulation with 1-inch mesh poultry netting and apply two coats of insulating finish cement 1-inch thick over entire surface. Cover with 6-ounce canvas and two (2) coats of mastic. Glass fabric may be used in lieu of 6-ounce canvas. Repair separation of joints or cracking of insulation.

END OF SECTION

SECTION 23 11 00
FACILITY FUEL PIPING

PART 1 : GENERAL

1.01 WORK INCLUDED

Diesel gas piping system, equipment, and connections.

1.02 REQUIRED SUBMITTAL DATA

A. See Division 1 of the WSDOT Special Provisions for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Shop Drawings: Indicate tanks, system layout, pipe sizes, location, and elevations. For fuel oil tanks, indicate dimensions and accessories, including utility access holes and hold-down straps.

D. Project Record Documents: Record actual locations of piping system, storage tanks, and system components.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views, and calibration charts.

1.03 CODES AND STANDARDS

A. NFPA 30 – Flammable and Combustible Liquids Code

B. NFPA 31 – Installation of Oil Burning Equipment

C. NFPA 37 – Installation and Use of Stationary Combustion Engines and Turbines

D. NFPA 110 – Standard for Emergency and Standby Power Systems

E. API 607 – Fire Test for Quarter-Turn Valves and Valves Equipped with Nonmetallic Seats

F. API 2000 – Standard Specification for Venting Atmospheric and Low-Pressure Storage Tanks

G. ASME B16.11 – Standard Specification for Forged Fittings, Socket-Welding and Threaded

H. ASME B36.10 – Standard Specification for Welded and Seamless Wrought Steel Pipe

I. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

J. ASTM A182/A182M – Standard Specification for Forged or Rolled Alloy and Stainless-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

K. ASTM D5677 – Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Pipe Fittings, Adhesive Bonded Joint Type, for Aviation Jet Turbine Fuel Lines

L. NFPA 30 – Flammable and Combustible Liquids Code

M. Conform to applicable EPA, State of Washington, and local regulations for installation of fuel oil systems.

1.04 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00 “Common Work Results” for Plumbing apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCT

2.01 FUEL PIPING AND VENT PIPING, ABOVE AND BELOW GROUND

A. DIESEL

1. Fuel Piping, above grade

   a. Carbon Steel Pipe comply with ASTM A53/A53M, Type E or S, Grade B, seamless or electric welded, Schedule 80 for pipe less than 2½-inches in diameter or Schedule 40 for pipe 2½-inches in diameter and larger.

   b. End connections: forged, socket weld type, complying with ASTM A182/A182M and ASME B16.11 for pipe or fittings less than 2½-inches.

2. Fuel Piping, below grade

   a. Provide double-wall flexible piping reinforced with epoxy with UL label as manufactured by OPW, AO Smith Inland, or approved equal.

   b. Fiberglass pipe and fitting shall be joined together per pipe manufacturer recommended method.

   c. Primary and secondary piping shall be of the same specified material. The secondary piping shall be minimum one pipe size larger than primary piping and constructed of high-density polyethylene and able to withstand H-20 loading requirements.

   d. Fittings below grade shall be minimized by running continuous pipe.

3. Exterior Containment Piping System:
    a. Factory fabricated, double wall complying with ASME B31.3 and NFPA 30.
    b. Physical Characteristics:
        1) Fiberglass reinforced plastic (FRP) complying with ASTM D5677.
        2) Chemically compatible with the type of fuel handled.
        3) Non-corrosive
        4) Dielectric.
        5) Non-biodegradable
        6) Microbial resistant.
        7) Pressure limitation is minimum 5 psig air pressure.
    c. Design Characteristics:
        1) Piping and support allow drainage.
        2) Allows for complete inspection of the product piping prior to sealing of containment piping.
        3) Pipe supports shall be designed based on pipe size, fuel weight, and operating condition to evenly separate containment piping from product piping.
        4) Supports shall be constructed of same material as product piping.
        5) Design to allow for pipe movement of both product piping and exterior containment piping without causing damage to either.
    d. Basis of Design: OPW, A.O. Smith Inland, or equal.
4. Transition sumps:
    a. Factory fabricated, polyethylene sump/fiberglass sump.
    b. Non-corrosive.
    c. Pressure Limitation: Capable of withstanding 50 psig minimum air pressure.
    d. Provide adequate pipe supports for pipes installed in the sump.
    e. Supports shall be constructed of same material as product piping.
    f. Pipe supports shall be designed based on pipe size, fuel weight, and operating condition to evenly separate containment piping from product piping.
    g. Supports shall be constructed of same material as product piping.
    h. Design to allow for pipe movement of both product piping and exterior containment piping without causing damage to either.
    i. Basis: OPW PST or equal.

2.02 BALL VALVES

Forged carbon steel, two-piece body, complying with API 607, threaded ends, rated 1500 psi WOG cold non-shock and 29 inches Hg, Federal Specification WW-V-35C, Type: II, Composition: CS, Style 3., provide locking handles for field locations, RPTFE seats and packing, blowout-proof stem, and adjustable packing gland.

2.03 CHECK VALVES

Provide carbon or stainless-steel spring-loaded check valve with NPT connections. Check valve disc shall be compatible with diesel fuel.

2.04 SOLENOID VALVES

Provide two-way, normally closed diaphragm solenoid valve with built in strainer. The solenoid valve shall be watertight and equipped with explosion-proof shell. Valve requires 120V for operation.

2.05 PRESSURE REGULATING

Pressure Regulating Valve: Carbon or SS body, steel disc, Teflon seat, steel stem and springs, automatic, direct, acting pressure actuated, threaded ends.

2.06 RELIEF VALVES

Provide overpressure relief valve carbon or stainless-steel body, steel disc, Teflon seat, steel stem and springs, automatic, direct, acting pressure actuated, threaded ends.

2.07 ANTI-SIPHON VALVES

Anti-Siphon Valve: Aluminum, bronze, or brass body, brass plug, spring loaded, normally closed, threaded ends, size to resist static siphon head. Locate on all suction lines where fuel level is at a higher elevation that the equipment and where shown on the drawings

2.08 STRAINERS

150-pound carbon steel, threaded connections, stainless steel basket, Buna-N or other fuel compatible gasket

2.09 FLOW INDICATOR

Flow Indicator: Carbon steel body, 150-psi rated glass, nylon wheel, as manufactured by OPW, Ernst, or McMaster Carr. Furnish on each day tank supply and return line, each pump and relief valve discharge, on lines serving main tank and tank selector valves, and at other locations required to properly assess the flow of fuel within the system.

2.10 FLEXIBLE CONNECTOR

Flexible Connector: Stainless-steel inner hose and braided exterior sleeve, suitable for minimum 200-psi WOG and 250°F. All flexible connectors must have welded (not swaged or crimped) ends. All flexible connectors must be vacuum rated.

2.11 TANK ALARM PANEL

Provide a tank alarm panel to monitor tank level, leakage in the tank and fuel piping sump. The panel shall be rated for outdoor installation. Panel shall have audio and visual indicator. Sensors equipped with the panel shall be compatible with the type of fuel handled. Basis of Design: OPW SiteSentinel, Omntec, Simplex Direct, or approved equal.

PART 3 : EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Route piping to avoid interference with structure, ceiling supports and framing, lights, and work of other trades. Provide offsets as required.

B. Keep openings in piping and ends of pipe closed during installation.

C. Provide for all expansion, locating offsets and spring pieces where necessary.

D. Ells shall be long radius.

E. Change size in piping with reducing couplings; bushings not acceptable.

F. Install exposed work neatly and skillfully; run pipes parallel to the closest wall; maintain maximum headroom; avoid light fixtures.

G. Correct piping leaks immediately; use new materials; leak-sealing compounds or peening not permitted.

H. Identify piping systems including underground piping.

I. Install valves with stems upright or horizontal, not inverted.

J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

K. Slope underground fuel supply and vent piping back to storage tank.

L. Secondary containment pipe shall be positioned over product pipe prior to bonding the product piping. After testing the product pipe, the containment fittings shall be assembled. The containment system shall then be tested.

M. Secondary containment pipe shall be 4-inch diameter minimum. It is acceptable to group primary pipes in a common secondary containment pipe per the pipe manufacturer’s recommendations.

N. Contractor shall be responsible for supplying fuel for performing system testing and functional testing.

3.02 TESTING OF SYSTEM

A. Follow manufacturer’s testing requirements. Contact local Fire Marshal at least 72 hours in advance of all testing.

B. Manufacturer's representative shall conduct all testing.

C. Primary (Product) Piping Test: Hydrostatically test system at 100-psi and check for leaks. Repair all leaks and retest until proven watertight. Flush system thoroughly with diesel fuel until all moisture or debris is removed and diesel is clear. Fill system with clean diesel fuel, close end valves, and allow system to remain full. Legally dispose of flushed diesel.

D. Secondary Containment Piping Test: Seal secondary containment piping to primary piping at both ends with concentric termination fittings as recommended by the manufacturer. Provide test gauge and pipe connection at this point for pneumatic testing. Pneumatically test system at 10 psi for ten (10) minutes, then soap all joints, and check for leaks. Retest until there are no leaks, and system is proven tight.

E. Contractor shall be responsible for all costs associated with supplying fuel required to perform all testing and demonstrations of the systems.

3.03 FUNCTIONAL TESTING

A. Before witness testing and/or commissioning the system, perform these steps to ensure the system is ready for final acceptance test as required:

1. Ensure all devices are in place and operational.
2. Ensure all controls are operational.
3. Move fuel through system filling to verify control sequences.
4. Clean all strainers.

B. Perform a complete system commissioning in accordance with the approved commissioning plan.

3.04 DEMONSTRATION

Train Owner's personnel on system layout, operational procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance as required by system equipment.

END OF SECTION

SECTION 23 13 00
FACILITY FUEL-STORAGE TANKS

PART 1 : GENERAL

1.01 WORK INCLUDED

Provide and install a 550-gallon Double wall Steel Above ground Diesel Storage tank. Tank storage volume shall be 550 gallons. Tank shall be 51 inches in diameter and 75-inches long. The tank shall be designed for aboveground storage of flammable and combustible liquids at atmospheric pressure. Tank shall be delivered as a complete UL-listed assembly with two factory-supplied, welded-on saddles. Size and location of saddles shall be as required to be set level on a solid foundation. Tank shall be designed for possible relocation at a future date. Concrete encased tank designs are not equal and will **not** be permitted.

1.02 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00 apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

1.03 SCOPE OF WORK

Aboveground fuel storage tanks: Provide a complete integrated emergency fuel system for the diesel driven emergency generator. This specification requires system coordination, equipment installation guidance, programming, startup, training and fuel stabilization treatment to be the responsibility of a single specialized fuel system, supplier. This specification section includes contractual responsibility for all materials, labor. Design, and code compliance permits inspections.

1.04 REQUIRED SUBMITTAL

Tank cutsheet and accessories including manufacturer's installation instruction and tank calibration chart.

1.05 CODES AND STANDARDS

A. All codes and standards refer to the current edition accepted by the local authority having jurisdiction (AHJ) unless otherwise noted.

1. ASME B31.1 – Power Piping.
2. ASME B31.4 – Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids.
3. ASME B31.9 – Building Service Piping.
4. ASME A13.1 – Labeling Guide (General Pipe Marking Standards).
5. API 2000 – Venting Atmospheric and Low-Pressure Storage Tanks.

6. ASME RTP1 – Reinforced Thermal Plastic Corrosion-Resistant Equipment.
7. ASME Section 9 – Welding and Brazing Qualifications.
8. ASME B16.3 – Malleable Iron Threaded Fittings.
9. ASME B36.10 – Welded and Seamless Wrought Steel Pipe.
10. ASTM A53 – Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
11. ASTM A234 – Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
12. ASTM D4021-Standard Specification for Glass-Fiber-Reinforced Polyester Underground Petroleum Storage Tanks
13. Building Officials and Code Administrators (BOCA) National Fire Prevention Code.
14. California Air Resources Board – Ambient Air Quality Standards
15. International Fire Code
16. NFPA 1 – Uniform Fire Code
17. NFPA 30 – Flammable and Combustible Liquids Code.
18. NFPA 31 – Installation of Oil Burning Equipment.
19. NFPA 37 – Installation and Use of Stationary Combustion Engines and Turbines.
20. NFPA 70 – National Electric Code.
21. NFPA 99 – Standard for Healthcare Facilities.
22. NFPA 110 – Standard for Emergency and Standby Power Systems.
23. Southern Building Code Congress International (SBCCI) Standard Fire Prevention Code.
24. UL 142 – Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids
25. UL 508 – Standard for Industrial Control Equipment.
26. Conform to applicable EPA, State of Washington, and Local Regulations for installation of fuel oil systems.
27. Any local codes, ordinances, and requirements of utility companies furnishing services to installation.

1.06 RELATED WORK

A. All portions of specification Division 1 apply to this work.

B. All portions of specification Section 23 05 00 apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

D. Additional section of the electrical specifications may be required to provide a fully functional system. Refer to specification index.

1.07 QUALITY ASSURANCE

A. Tank shall comply with the latest edition of NFPA 30. The tank's secondary containment must be tested for tightness in the factory and in the field before commissioning. Tank shall be supplied with emergency vents for the primary and the secondary containment tanks. Emergency venting by "form of construction" is not equal and will **not** be permitted.

B. Inner and Outer Tank shall be manufactured in accordance with UL 142. The tank system shall also meet or exceed the requirements of:

1. NFPA 30A – Automobile and Marine Service Station Code.

C. Fuel System Installer Qualifications:

1. Provide proof of license, registration, and certification required to install and service fuel systems in the State of Washington.
2. Provide certification for installing and testing as approved contractor by systems manufacturer. Contractor shall provide evidence of certification to State and the Owner prior to installation.
3. Provide minimum two years documented experience installing gasoline fuel systems.
4. Manufacturer: Equipment, controls and all fuel specialty devices shall be provided by a single supplier to ensure a complete functional and coordinated system with single source responsibility. Supplier shall give guidance to equipment and device installation and shall complete all programming, commissioning, and Owner training. The supplier shall be a firm with five (5) years of documented experience in the installation of emergency fuel systems.
5. Installer: Company specializing in performing the work of this Section with minimum three (3) years of documented experience. Bidding contractor shall hold license(s) as required by the AHJ.
6. Pollution Liability Insurance: Required by both Subcontractor and system Supplier. Subcontractor and Supplier may provide the required coverage as part of their general liability insurance coverage. If Subcontractor's and Supplier's general liability insurance excludes such coverage, then Subcontractor must maintain a pollution Liability policy that includes coverage for fuel spillage/contamination events, such as system failures, or leaks, in a minimum amount of $1,000,000 per occurrence and in aggregate. Such policy must name Owner, Owner's Lender(s), and Contractor as additional insureds and contain a waiver of subrogation in favor of Owner, Owner's Lender(s), and Contractor.
7. Professional Liability Insurance: If Subcontractor's and Supplier's scope includes any design or system recommendations, then the Subcontractor and Supplier must carry Professional Liability: $1,000,000 per claims made and in aggregate. If Subcontractor's or Supplier's general liability insurance excludes such coverage, then Subcontractor or Supplier must maintain a professional liability policy that includes coverage for design

work related to fuel oil systems and the related design and specification work. This coverage must protect the Subcontractor, Contractor, Owner, and Owner's Lender(s) from liability arising out of errors and omissions in the performance of design and/or engineering services provided by Sub-contractor, its employees, or consultants.

8. Valves: Manufacturer's name and pressure rating marked on valve body.
9. Welding Materials and Procedures: Conform to ASME Code.
10. Welders Certification: In accordance with ASME Section 9.
11. Maintain one copy of each document at the Project Site.

1.08 REGULATORY REQUIREMENTS

Submit and comply with all the requirements of the EPA, state and local authorities having jurisdiction. Include installation permit/fees for fuel storage tank and all accessories and appurtenances.

PART 2 : PRODUCT

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state, and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Country of Origin: All material and equipment specified in this section shall be made in the USA of domestic materials.

2.02 ABOVEGROUND FUEL STORAGE TANKS

A. MANUFACTURERS

1. Ace Tank Inc.
2. Approved equal

B. PRODUCT-STORAGE REQUIREMENTS

1. All primary tanks must be vented. Tanks are designed for operation at atmospheric pressure only, except for use with vapor recovery systems at a pressure or vacuum not to exceed 1 psig (7 kPa).
2. Tanks shall be capable of storing liquids with specific gravity up to 1.1.
3. Tank shall be capable of storing the following products:
   a. Diesel fuel oils for oil burning equipment at temperatures not to exceed 150°F.
   b. Biodiesel-diesel blends with up to 100% biodiesel (B100 per ASTM) at ambient temperatures.

C. MATERIALS

1. Tank shall be fabricated per UL 142 of mild carbon steel with shell seams of continuous lap weld construction.

2. Tank shall be of double wall construction and provide complete secondary containment of the primary storage tank's contents by an impervious steel outer wall.
3. Lifting lugs shall be provided at balancing points to facilitate handling and installation.
4. Exterior Protective Coating:
    a. Surface Preparation: Grit blast – SSPC-SP-6 White Blast.
    b. Finish: White finish paint system 5-7 DFT on the shell and heads.
5. Threaded fittings with thread protectors shall be supplied as follows (all fittings must be located on tank top per UL):
    a. One (1) 2-inch – Interstitial Monitoring.
    b. One (1) 2-inch – Normal Vent, Primary Tank.
    c. One (1) 4-inch, 6-inch, or 8-inch – Emergency Vent, Primary Tank.
    d. One (1) 4-inch, 6-inch, or 8-inch – Emergency Vent, Secondary Tank.
    e. One (1) 4-inch or 6-inch – Product Fill.
    f. One (1) 2-inch or 4-inch – Product Pump or Supply.
    g. One (1) 2-inch or 4-inch – Liquid Level Gauge.
6. Dimensional Requirements
    a. As indicated on the drawings.

D. MONITORING CAPABILITIES

1. Double-wall tanks shall have a monitoring space between the walls to allow for the free flow and containment of leaked product from the primary tank. The monitoring space shall provide equal communication in all directions.

E. TANK ALARM PANEL

1. Refer to Section 23 11 00 for tank alarm panel specifications.

F. ACCESSORIES

1. Flanged Manways
    a. The standard manway is 18-inches in diameter and will be furnished with UL listed gaskets and covers (30-inch and 36-inch manways are optional).
2. Tubes – Fill tubes of appropriate design shall be supplied by Contractor.
3. Tank Sumps
    a. UL label shall be affixed to tank sump components.
    b. Tank sumps and collars shall be listed by Underwriters Laboratories for petroleum fuels and all blends of alcohol (same as tank). Collar and sump shall be tested and listed as a complete sump system.

c. Tank sump components shall be constructed of fiberglass reinforced plastic.

4. Liquid Sensor Drawstring

a. Galvanized steel drawstring shall be factory installed at the monitoring fitting to facilitate field insertion of sensor.

5. Fittings Threaded NPT

a. All threaded fittings shall be located on a manway cover or within 12-inches of the tank top center line. Fittings to be supplied with temporary thread protectors or threaded plugs.

b. All standard fittings shall be NPT half couplings.

c. Internal piping shall be terminated at least 6-inches from the tank.

2.03 FLAME ARRESTOR

Flame Arrestor: Each main tank shall include a flame arrestor on the normal vent connection with cast iron body, cast iron cover, brass cap, and stainless-steel arrestor plates.

2.04 OVERFILL PREVENTION VALVE

Overfill Prevention Valve: Each main tank compartment shall include an overfill prevention valve in the refueling connection port to automatically stop the flow of fuel into the tank at 90% of maximum tank capacity. The valve shall be a two stage, float operated and suitable for either above grade or below grade tanks as required by project conditions. Tanks 3,000 gallons and smaller shall have a 2-inch valve, larger tanks shall have a 3-inch valve. Valve assembly shall be UL listed and include a drop tube extended to within 6-inches of tank bottom.

2.05 FILL EQUIPMENT SHALL INCLUDE:

A. SPILL CONTAINER

1. Cover: Cast aluminum
2. Mounting Ring: Cast iron E-coating
3. Bellows: Polyethylene
4. Base: Cast iron E-coating
5. Clamps: Stainless steel
6. Seals: Nitrile
7. OPW 1-2100 Series or equal.

a. Base with drain valve: OPW 1-2100C-DEVR.

b. Vapor-Tight overfill valve: OPW 71S0-410C or equal.

c. Top seal cap: OPW 634TT-7085-EVR.

d. Swivel Adaptor: OPW 61SALP-1020-EVR.

e. Drop tube/remote fill: OPW 61SOR-4000.

PART 3 : EXECUTION

3.01 GENERAL

A. Thoroughly clean parts and fitting prior to installation.

B. Furnish necessary bolts or anchors required to secure equipment in place.

3.02 TESTING OF SYSTEM

A. Follow manufacturer's testing requirements. Contact local Fire Marshal at least 72 hours in advance of all testing.

B. Manufacturer's representative shall be conducting all testing.

3.03 FUNCTIONAL TESTING

A. Before witness testing and/or commissioning the system, perform these steps to ensure the system is ready for final acceptance test as required:

1. Ensure all devices are in place and operational.
2. Ensure all controls are operational.
3. Move fuel through system filling to verify control sequences.
4. Clean all strainers.

B. Perform a complete system commissioning in accordance with the approved commissioning plan.

3.04 DEMONSTRATION

Train Owner's personnel on system layout, operational procedures, and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance as required by system equipment.

END OF SECTION

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SECTION 23 20 00
HVAC PIPING

PART 1 : GENERAL

1.01 WORK INCLUDED

Piping and fittings.

1.02 REQUIRED SUBMITTAL DATA

None.

1.03 CODES AND STANDARDS

A. All standards refer to the current edition.

1. ASTM A53 – Pipe, Steel, Black and Hot-Dipped Zinc-Coated, Welded and Seamless.
2. ASME A234 – Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A795 – Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection.
4. ANSI B9.1 – Mechanical Refrigeration Pipe.
5. ANSI B16.9 – Factory-Made Wrought Steel Butt Welding Fittings.
6. ASME B16.22 – Wrought Copper and Bronze Solder-Joint Pressure Fittings.
7. ANSI B16.25 – Butt Welding Ends for Pipe, Valves, Flanges, and Fittings.
8. ASME B16.29 – Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings – DWV.
9. Washington State Energy Code Commercial Provisions, latest adopted version.
10. ASTM B43 – Seamless Red Brass Pipe, Standard Sizes.
11. ASTM B75 – Seamless Copper Tube.
12. ASTM B813 – Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
13. ASTM C564 – Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
14. ANSI Z49.1 – Safety in Welding and Cutting.
15. ASTM A234 – Seamless and Welded Wrought-Steel Welding Fittings.
16. NFPA 13 – Installation of Sprinkler Systems.
17. IBC (International Building Code).
18. IMC (International Mechanical Code).
19. IFGC (International Fuel Gas Code).

20. NEC (National Electrical Code).
21. CSA (Canadian Standards Association – Formerly American Gas Association).
22. UL 1738.
23. ULC S636.

1.04 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00 “Common Work Results for HVAC” apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCT

2.01 PIPING SYSTEMS

A. All material in conformance with the standards listed in 2.01.

1. Generator and Diesel Pump Exhaust Pipe
   a. Pipe: Black steel, Schedule 80, ASME A106, Grade B.
   b. Fittings: Black steel standard weight butt-welding for piping 2½-inch and larger with 300-lb. forged steel flanges, ASTM A23, Grade WPB.
2. Cooling Unit Condensate Drain Piping:
   a. Pipe: Type L hard copper tube 1-inch and smaller, ASTM B75. DWV copper 1¼-inch and larger, ASTM B306.
   b. Fittings: Wrought copper or bronze solder pressure fittings for Type L tube, ASTM B75. Wrought copper solder joint drainage fittings for DWV tube, ASME B16.29.
3. Mechanical Refrigeration Piping:
   a. Pipe: ACR Type L hard copper, cleaned, dehydrated, and seal ends, ANSI B9.1.
   b. Fittings: Wrought copper or bronze solder fittings, except refrigerant flare fittings may be used for connections to equipment with flare connections, ASME B75.

2.02 UNIONS

A. Copper tube, Sweat, Nibco #733, Grinnell-ITT #9730, EPC #4733.

B. Steel pipe, threaded 2-inches and under, malleable-iron 250-lbs. ground joint.

C. Steel pipe, welded 2½-inches and over, flange unions 150-lbs. forged steel.

D. Dielectric unions, soldered to threaded 2-inches and below, flanged 2½-inches and above. Select gasket for pressure and temperature range of service. Capitol Series CS or F, Epco “Dielectric Union.”

2.03 PIPE FLANGE BOLTS

High temperature exhaust shall be ASTM A193, Grade B8M.

2.04 PIPE SLEEVES

A. Sleeves in exterior walls, walls below grade, and floor slabs on grade up to 25-inches in diameter: Molded non-metallic high-density polyethylene. Sleeves shall have integrally formed water stop a minimum of 4-inches larger than the outside diameter of the sleeve itself. Each sleeve shall be provided with end caps to prevent deformation during concrete pour. Sleeve assembly shall be PSI Thunderline Link-Seal Model CS CenturyLine, or equal.

B. Sleeves in concrete floor slabs above grade and concrete roofs: 20-gauge galvanized sheet steel with lock seam joints, or pre-formed factory-fabricated plastic sleeves.

C. Sleeves through concrete beams and concrete, masonry, or tile walls above grade: Schedule 40 galvanized steel pipe sleeves.

2.05 PIPE SEALS

A. Watertight seals shall be modular, mechanical, interlocking HDPE thermoplastic links in accordance with ASTM D2000 M3 BA510. Pressure plates shall be molded glass reinforced nylon. All fasteners shall be mild steel coated with both zinc dichromate and an organic corrosion resistance coating. Seals shall be suitable for use in water direct ground burial and atmospheric conditions from −40 to 250°F, PSI Thunderline Model “C” Link-Seal, or equal.

B. Fire stopping seals shall be USG Interiors Inc. Thermafiber Safing insulation and Thermafiber Smoke Seal, or equal.

2.06 ESCUTCHEON RINGS

A. Chrome-plated split ring type.

B. Deep recessed type on pipes with sleeves through floor which extend above finished floor line to conceal pipe sleeve.

2.07 GENERATOR AND DIESEL PUMP EXHAUST THIMBLE

Carbon steel generator exhaust wall thimble. Conforms to NFPA 37 and 110. GT Exhaust model 20.

PART 3 : EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Route piping to avoid interference with structure, ceiling supports and framing, lights, and work of other trades. Provide offsets as required.

B. Keep openings in piping and ends of pipe closed during installation.

C. Provide for all expansion, locating offsets and spring pieces where necessary.

D. Ells shall be long radius.

E. Change size in piping with reducing couplings; bushings not acceptable.

F. Install all piping parallel with the building and other piping.

G. Cut pipe accurately to measurement established on building and work into place without springing or forcing.

H. Piping installed on fill, excavated areas, and backfill shall be adequately supported on beams supported by the building structure and undisturbed earth.

I. Install piping concealed in finished rooms, unless indicated otherwise.

J. Install exposed work neatly and skillfully; run pipes parallel to the closest wall; maintain maximum headroom; avoid light fixtures.

K. Correct piping leaks immediately; use new materials; leak-sealing compounds or peening not permitted.

3.02 WELDED PIPE JOINTS

A. QUALIFICATIONS AND PROCEDURES

1. Piping joints on generator and diesel pump exhaust shall be welded using procedures, welders and welding operators qualified in accordance with ASME B31.1, and applicable state labor requirements. No welding shall proceed until procedures and personnel have been approved as qualified. The Contractor shall submit copies of certified reports of welder's qualification tests and welding procedures to the Engineer for approval at least 21 days prior to the start of work.
2. Employ only welders holding one of the following certificates, dated within the preceding three months or dated earlier with documented records indicating acceptable continuous welding has been performed since certificate was issued.
    a. Certificate of the National Certified Pipe Welding Bureau.
    b. Certificate from a recognized testing laboratory indicating satisfactory welding test results in accordance with ASME Boiler and Unfired Pressure Vessel Code, Section 9, "Welding Qualifications." If in the opinion of the Engineer the work of a welder creates a reasonable doubt as to his skill, additional tests may be ordered by the Engineer at the Contractor's expense.
3. Safety Standards: Welding practice shall comply with the latest edition and amendments of ANSI Z49.1 "Safety in Welding and Cutting."
4. Where welders make additions to an ASME stamped product in the field (i.e., boiler tank, etc.), welders shall be tested and qualified under the requirement of the ASME Boiler and Pressure Vessel Code.

B. WELDING

1. Beveling: Field or shop bevel by mechanical means or flame cutting. Where beveling is done by flame cutting, thoroughly clean surface of scale and oxidation just before welding. Bevel to conform to recognized standards.
2. Alignment: Girth butt welds and welded branch connections. Complete penetration welds shall be made without backing rings.
3. Defective welds will not be accepted. Defective welds are those which fail to comply with ANSI B31.1 and those which result in leakage during testing of piping. Defective welds shall be corrected by the Contractor at no additional cost to the Owner. Pipe and fittings with defective welds which cannot be satisfactorily corrected, as determined by the Engineer, shall be replaced with new pipe and fittings at no additional cost to the Owner.
4. Electrodes: Store electrodes in a dry heated area. Keep free of moisture and dampness during fabrication operations. Discard electrodes that have lost part of their coating. Use low hydrogen type E7018, or equal. Use E6010 SMAW or ER705-2 GTAW filler metal for root pass on open butt welds.
5. Welds shall be thoroughly fused and otherwise sound throughout. Contours shall be uniform with regular even ripples. Surfaces shall not be dressed, smoothed, or otherwise finished to improve their appearance, except as necessary to correct defects. Welds shall be free from gas pockets, oxides, slag inclusions, and surface porosity, except very small pores. Oxides and slag will be permitted if widely dispersed. Welds shall be free from overlaps, undercuts, and excessive convexity. Internal surfaces of pipe and fittings shall be free from weld metal globules or other inward protrusions at the welded joints.

C. EXAMINATION OF WELDS

1. Final visual inspection in accordance with ASME B31.1.
2. Inspection records: In accordance with ASME B31.1.

3.03 COPPER PIPING JOINTS

Note: Contractor to provide sweated joints in compliance with the method outlined in ASTM B828.

A. Ream thoroughly to remove all burrs.

B. Polish contact surfaces of fittings and pipes with emery cloth, sandpaper, or steel brush, and wipe clean before fluxing male and female surfaces of joints.

1. Steel wool not permitted for polishing.

C. Apply a thin even coating of flux with a brush to both tube and fitting as soon as possible after cleaning.

D. Insert the tube end into fitting cup, making sure that the tube is seated against the base of the fitting cup. Employ a slight twisting motion while inserting tube. Remove excess flux from the exterior of the joint with a cotton rag.

E. Support the tube and fitting assembly to ensure a uniform capillary space around the entire circumference of the joint.

F. Preheat the fitting and tube evenly and take care to avoid burning the flux.

G. Apply solder to the fitting while concurrently heating the fitting/tube.

1. Water flushable solder for all potable water systems in conformance with the Uniform Plumbing Code (UPC) and ASTM B813 “Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.”

a. 95-5 solder, lead free Bridgit or Silvabrite solder for aboveground joints.

b. Sil-fos or Sil-braz on all underground work.

H. Provide solder unions, ground joint or flanged joints where necessary for access to equipment.

I. Coordinate installation of unslit insulation with piping installation for refrigeration piping. See Section 23 11 00 “HVAC Insulation.”

3.04 UNIONS

A. Provide unions at all connections to equipment and where necessary to disconnect for repairs.

B. Use union fittings wherever practicable to save joints.

C. Provide dielectric unions between iron and copper pipe.

3.05 PIPE SLEEVES

A. Provide and locate all sleeves and inserts required before the floors and walls are built, or be responsible for the cost of cutting and patching required for pipes where sleeves and inserts were not installed, or where incorrectly located.

B. Provide sleeves for all mechanical piping passing through concrete floor slabs or roof slabs and concrete, masonry, and tile wall construction. Select the wall/floor sleeve size and type according to seal manufacturer’s recommendations.

C. Where above-grade pipe motion due to expansion and contraction or earthquake will occur, make sleeves of sufficient diameter to permit free movement of pipe. Where sleeves pass insulated pipes without a vapor barrier, size the sleeves large enough to pass the pipe only and butt insulation against the construction. For pipes requiring insulation having a vapor barrier, size the sleeves large enough to pass the pipe and insulation. Check floor and wall construction finishes to determine the proper length of sleeves for various locations; make actual lengths to suit the following:

1. Terminate sleeves flush with walls, partitions, and ceiling.
2. In areas where pipes are concealed, as in chases, terminate sleeves flush with floor.
3. In all areas where pipes are exposed, extend sleeves ¼-inch above finished floor, except in rooms having floor drains, where sleeves shall be extended ¾-inch above floor.

D. Fasten sleeves securely in floors, roofs, and walls so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials from being forced into the space between the pipe and sleeve during construction.

3.06 PIPE SEALS AND ESCUTCHEON RINGS

A. At exterior walls, walls below grade and floor slabs on grade, provide watertight seal. Core drill round opening in existing concrete in accordance with seal manufacturer's recommendations. Install assembly to provide a penetration capable of withstanding a 20-psi differential pressure across the seal.

B. At firewall, floor, and roof penetrations, seal annular space at pipes with fire stopping insulation and 2-inch minimum coating of smoke seal.

C. Fill annular space at all other piping penetrations with fiberglass batt insulation to a compressed fit.

D. Provide escutcheon rings for all exposed uninsulated pipes passing through walls, floors, and ceilings.

3.07 GENERATOR AND DIESEL PUMP EXHAUST THIMBLE

Install per manufacturer's written instructions.

END OF SECTION

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SECTION 23 30 00
HVAC AIR DISTRIBUTION

PART 1 : GENERAL

1.01 WORK INCLUDED

A. Duct systems.

B. Hangers and supports.

C. Hardware and accessories.

D. Wall louvers.

E. Seismic protection of ductwork.

1.02 REQUIRED SUBMITTAL DATA

A. Wall louvers.

B. Wall louvers.

C. Drawing indicating seismic protection requirements of ductwork.

D. Pressure testing agenda, blower certification, and test results.

1.03 CODES AND STANDARDS

A. Comply with the current editions of the following standards unless specified or indicated otherwise:

1. ASHRAE Guide Equipment Volume: Duct Construction, Chapter 1.
2. “SMACNA HVAC Duct Construction Standards”.
3. “SMACNA Industrial Duct Construction Standards”.
4. “SMACNA Seismic Restraint Manual – Guidelines for Mechanical Systems”.
5. NFPA 90A.
6. NFPA 90B.
7. NFPA 96.
8. Washington State Energy Code Commercial Provisions, latest adopted version.
9. Insulation shall comply with UL 181 and NFPA 90A.
10. All electrical components shall be UL listed and installed in accordance with the National Electric Code.
11. Attachments to the ceiling system shall be in accordance with UBC.

12. The entire assembly of all electrically driven devices (including air terminal units) shall be UL or ETL listed.

1.04 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00, Common Work Results for HVAC apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCT AND FABRICATION

2.01 EXTERIOR WALL LOUVERS

A. Ruskin ACL1245 formed aluminum, Porttoff, Greenheck, or approved equal.

B. ½-inch mesh aluminum screen.

2.02 GENERATOR EXHAUST

A. Provide prefabricated chimney and components shall meet NFPA 37and UL standards. The exhaust stack shall be listed for temperatures of maximum 1000°F.

B. The factory-built stack shall be designed and installed to be gas tight and consist of 2 walls. The inner wall shall be constructed from 304 or 316 stainless steel and the outer casing shall be constructed from galvalume, 304 stainless or 316 stainless steel.

C. Non-stainless-steel surfaces exposed outside shall be protected by minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for high temperature.

D. All section joints shall be connected and sealed with factory supplied locking bands at the outer wall. Use appropriate sealant as specified in the manufacturer’s installation manual.

E. Provide all fittings and accessories from a single manufacturer.

F. Basis: Duravent model DAS, DIS or accepted equal

PART 3 : EXECUTION

3.01 EXAMINATION

A. Inspect areas to receive louvers. Notify the Engineer of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

B. If opening preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

C. The installation of generator exhaust shall be in accordance with the manufacturer's installation instructions and recommendations and shall conform to all applicable state and local codes.

3.02 PREPARATION

A. Clean opening thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.

B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

C. The supporting structure shall be designed to accommodate the point loads transferred by the louvers when subject to the design wind loads.

D. Install joint sealants.

END OF SECTION

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SECTION 23 34 16
HVAC FANS

PART 1 : GENERAL

1.01 SECTION INCLUDES

Inline fans.

1.02 RELATED REQUIREMENTS

A. Section 23 05 13 “Common Motor Requirements for HVAC Equipment.”

B. Section 23 05 48 “Vibration and Seismic Controls for HVAC.”

1.03 REFERENCE STANDARDS

ABMA STD 9 – Load Ratings and Fatigue Life for Ball Bearings.

1.04 SUBMITTALS

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. See Section 23 05 00 “Common Work Results for HVAC” for submittal procedures.

C. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

D. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

E. Manufacturer’s Instructions: Include complete installation instructions.

1.05 QUALITY ASSURANCE

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

PART 2 : PRODUCTS

2.01 GENERAL DESCRIPTION

A. Base fan performance at standard conditions (density 0.075 Lb/ft3)

B. Performance capabilities up to 27,400 cubic feet per minute (cfm) and static pressure to 3.0 inches of water gauge

C. Fans are available in twenty-four sizes with nominal wheel diameters ranging from 8 inches through 33 inches

D. Normal operating temperature up to 130 Fahrenheit (54.4 Celsius)

E. Applications include: intake, exhaust, return, or make-up air systems

F. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

G. Basis: Greenheck, Loren Cook Company or Twin City Fan & Blower.

2.02 WHEEL AND INLET

Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.

2.03 HOUSING

A. Constructed of aluminum

B. Statically and dynamically balanced in accordance to AMCA Standard 204-05

C. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

D. Single thickness blades are securely riveted or welded to a heavy gauge back plate and wheel cone.

2.04 BEARINGS AND DRIVES

A. Electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.

B. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.

C. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor or integrated variable frequency drive.

D. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Install fan restraining snubbers; refer to Section 23 05 48. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

END OF SECTION

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SECTION 23 80 00
DECENTRALIZED HVAC EQUIPMENT

PART 1 : GENERAL

1.01 WORK INCLUDED

Split System Heat Pumps.

1.02 REQUIRED SUBMITTAL DATA

Split System Heat Pumps.

1.03 CODES AND STANDARDS

A. ASTM B117 – Standard Practice for Operation Salt Spray Apparatus

B. Washington State Energy Code Commercial Provisions, latest adopted version

C. National Electrical Code

D. NEMA MG1 – Motors and Generators

E. NFPA 90A – Installation of Air Conditioning and Ventilation Systems

F. NFPA 90B – Installation of Warm Air Heating and Air Conditioning Systems.

G. OSHA

H. SMACNA – HVAC Duct Construction Standards.

I. UL 1995 – Heating and Cooling Equipment

J. All electrically-driven units shall be tested and rated as an assembled unit by Underwriters Laboratory (UL) or Environmental Testing Laboratory (ETL).

1.04 RELATED WORK

A. All portions of the WSDOT Division 1 Special Provisions apply to this work.

B. All portions of specification Section 23 05 00 apply to this work.

C. Additional sections of the mechanical specifications may be required to provide a fully functional system. Refer to the specifications index.

PART 2 : PRODUCT

2.01 DX SPLIT SYSTEM HEAT PUMP

A. SUMMARY

1. The contractor shall furnish and install split system air conditioner (s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS

1. Mitsubishi or approved equal.

C. GENERAL UNIT DESCRIPTION

1. The air conditioner system shall be a ductless split system with variable speed inverter compressor technology. The system shall consist of a wall mounted indoor section with wired, wall-mounted controller and a horizontal discharge, single-phase outdoor unit.
2. Unit(s) shall be 100% factory run-tested and fully charged with R-410A in the field per manufacturer's installation instructions.
3. The outdoor unit shall be capable of operating at 0°F (−18°C) ambient temperature without additional low ambient controls (optional wind baffle may be required).
4. The outdoor unit shall be able to operate with a maximum height difference of 100 feet indoor unit to outdoor unit.
5. System shall have a maximum refrigerant tubing length of 100 feet between indoor and outdoor units without the need for line size changes, traps, or additional oil.
6. Outdoor units shall be pre-charged for a refrigerant line length of 70 feet.
7. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.

D. INDOOR UNIT CABINET

1. The indoor unit cabinet shall be wall mounted by means of a factory supplied mounting plate.
2. The cabinet shall be formed from high strength molded plastic with front panel access for filter.
3. The indoor unit shall be factory assembled, wired, and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor.
4. The unit in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch.

5. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.

6. Indoor Fan:

   a. The evaporator fan (s) shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor.

   b. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.

   c. The fans shall have multiple speed settings.

7. Vane:

   a. There shall be a motorized horizontal vane to automatically direct airflow in a horizontal and downward direction for uniform air distribution.

   b. The horizontal vane shall significantly decrease downward air resistance for lower noise levels and shall close the outlet port when operation is stopped.

   c. There shall also be a set of vertical vanes to provide horizontal swing airflow movement.

8. Filter:

   a. Return air shall be filtered by means of an easily removable washable filter.

9. Evaporator Coil:

   a. The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing.

   b. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow.

   c. All tube joints shall be brazed with phos-copper or silver alloy.

   d. The coils shall be pressure-tested at the factory.

   e. A condensate pan and drain shall be provided under the coil.

   f. The casing shall be constructed from galvanized steel plate, coated with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. The coil shall be protected with an integral metal guard.

E. OUTDOOR CABINET

1. The fan grille shall be of ABS plastic.

2. Condenser Section:

   a. The L-shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris buildup.

   b. The coil shall be protected with an integral metal guard.

   c. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be controlled by a microprocessor-controlled step motor.

3. Compressor:
    a. The compressor shall be a DC rotary compressor with variable compressor speed inverter technology.
    b. The compressor shall be driven by inverter circuit to control compressor speed.
    c. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which results in vast energy savings.
    d. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor to maintain enough heat.
    e. The outdoor unit shall have an accumulator and high-pressure safety switch.
    f. The compressor shall be mounted to avoid the transmission of vibration.
4. Outdoor Fan:
    a. Outdoor unit shall be furnished with an AC fan motor.
    b. The fan motor shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.
    c. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front.
    d. The fan shall be provided with a raised guard to prevent contact with moving parts.
    e. Controls:
        1) The control system shall consist of two (2) microprocessors, one on each indoor and outdoor unit.
        2) Field wiring shall run directly from the indoor unit interconnected by a single non-polar two-wire AWG-16 stranded cable to the wall-mounted controller with no splices.
        3) The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.
        4) The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit.

PART 3 : EXECUTION

3.01 SPLIT SYSTEM

Furnish and install all accessories shipped with unit per manufacturer's recommendations.

END OF SECTION

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SECTION 26 00 00
ELECTRICAL GENERAL

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This Section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this Section. The electrical Drawings and schedules included in this project manual are functional in nature and do not specify exact locations of equipment or equipment terminations.

1.02 DEFINITIONS

A. The word "**provide**" is to furnish and install.

B. "**Owner**": Kitsap County.

C. "**Contractor**" is the party who furnishes and installs all materials and equipment. This includes the Prime Contractor, Electrical Contractor, Control System Integrator, and all other Contractors and Sub Contractors.

D. "**Control System Integrator**" also referred to as the System Integrator or Integrator or control system manufacturer is the Party that furnishes all control components and designs the detailed control wiring diagrams plus the layout and assembly of the custom control panels.

E. "**Control System**" includes all equipment, instruments, computers and wiring for control and monitoring of all operating pumps and equipment. This includes custom control panels, motor control center, packaged control panels, and control equipment furnished with other systems and mechanical equipment. All sensing, transmitting, indicating, control and recording of all functions as specified and shown are also included in the control system.

1.03 GENERAL DESCRIPTION OF WORK

A. The Contractor must:

1. Provide all labor, material, tools, equipment and services required to complete the furnishing, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical equipment, devices and components as indicated and implied by the Drawings and these specifications.
2. Provide identification (nameplates and wire tags) of all electrical equipment and wiring.
3. Complete the wiring to, connection to, adjustment and calibration of, testing of equipment having electric motors and/or built-in or furnished electrical components. Install electrical components that are furnished with mechanical equipment.

4. Complete the procurement, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical devices, components, accessories and equipment which is not shown or specified but which is nonetheless required to make the systems shown and specified function properly.
5. Provide the size, type and rating of motor control devices, equipment and wiring necessary to match the ratings of motors furnished with mechanical equipment.
6. Provide adequate space for the electrical installation, including but not limited to, determination of access-ways and doorways, shipping sections, wall and floor space, and space occupied by mechanical equipment. Provide electrical equipment that fits in the areas shown on the Drawings. All equipment shall be readily accessible for maintenance, shall have electrical clearances in accordance with NEC and shall be installed in locations that will provide adequate cooling.
7. Provide detailed wiring diagrams showing all equipment and instrumentation connections and terminations.
8. Check electrical equipment prior to installation so that defective equipment is not installed. Acceptance testing for electrical equipment shall be performed as discussed in Sections 26 32 00 & 26 36 00.
9. Provide start-up, follow-up and training of the Owner's personnel for electrical systems. Make all corrective measures required during start-up. See specific requirements for training and start-up in other specification sections.
10. Provide field services of qualified technicians to supervise and check out the installation of the equipment, to supervise and check out interconnecting wiring, to conduct start-up of operation of the equipment, and to correct any problems, which occur during start-up.
11. The RTU's, control panels, and instrumentation shall be shop tested in the Control System Integrator's shop.

1.04 EQUIPMENT COORDINATION

A. The Contractor is responsible to coordinate the equipment supplied from other manufacturers. This includes but is not limited to:

1. Obtaining specific information on equipment ratings and sizes and verifying the electrical components supplied meet, or match the requirements such as voltage, phase, frequency, starter types, etc.
2. Verifying the equipment supplied will fit within the space allocated.
3. Coordination of equipment and the electrical power and control requirements. Provided in all sections of the specifications and Drawings.
4. Providing power and control equipment, wiring, and raceways to meet the requirements of the mechanical equipment supplied.
5. Providing all necessary control wiring and components for any special requirements from an equipment manufacturer.

B. The Contractor shall verify as a minimum:

1. Correct overcurrent protective device rating, voltage, phase and frequency.
2. Size and space requirements.
3. Mounting requirements.
4. Correct motor starter type.
5. Proper coordination with the controls and control system Integrator.

C. Any discrepancies between the electrical and other equipment shall be brought to the immediate attention of the Engineer.

1.05 PROJECT DESCRIPTION

A. In general, the project consists of two new wastewater pump stations.

1. PS19 site includes a new structure which houses the electrical equipment and on-site generator for an in-ground wet well with submersible pumps.
2. PS31 site includes an electrical rack and controls for an in-ground wet well with submersible pumps.

B. The following statements highlight the main portion of the electrical work for all sites.

1. Coordinate with the local power utility and coordinate modifications to the existing power services and new power services to the site.
    a. Provide service entrance equipment.
    b. Provide motor controls and power distribution equipment and motor starters as shown on the Drawings.
    c. Provide an MCP – Main Control Panel with PLC for control and monitoring and alarming of all equipment.
    d. Install new telemetry panel, radio modem and antenna. Provide new antenna pole and antenna cable per the Drawings.
    e. Provide wet well floats.
    f. Provide all programming at the stations.
    g. Provide new flow meter and level transmitter instrumentation.
    h. Provide lighting and receptacles for the site.
    i. Provide wire and raceways for all equipment power and control circuits.
    j. Provide O&M, record drawings and training.

1.06 TEMPORARY OPERATION AND CONSTRUCTION POWER

A. FACILITY OPERATION POWER

1. If necessary, provide temporary power service for facility operation and construction needs. The Contractor shall pay for all coordination with the utility and associated construction costs for temporary power service.
2. Any necessary modifications and utility construction costs to the existing electrical system for construction power shall be coordinated and paid for by the Contractor.
3. The Contractor shall pay for the energy costs as billed by the utility for the temporary construction. The Owner shall be billed for Utility costs and usage for the new, permanent services and these costs for the permanent service shall not be included in the Contractors bid price.

1.07 REFERENCES

A. Permits, licenses, approvals and other arrangements for work shall be obtained and paid for by the Contractor and included in the bid price.

B. Electrical work shall be executed in strict accordance with the latest edition of the National Electrical Code and local ordinances and regulations.

C. All electrical equipment, materials, construction methods, tests and definitions shall be in strict conformity with the established standards of the following in their latest adopted revision:

1. Underwriters' Laboratories, Inc. (UL).
2. National Electrical Manufacturers Association (NEMA).
3. Canadian Standards Association (CSA).
4. Electrical Testing Laboratories (ETL).
5. Factory Mutual (FM).
6. All applicable Washington State Codes and local County Codes.

D. 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.

E. All materials shall be new, free from defects, of current manufacture, of quality specified or shown. Each type of material shall be of the same manufacturer throughout the work.

1.08 CONTRACT DOCUMENTS

The electrical layouts are generally diagrammatic. The location of equipment is approximate unless dimensioned. Exact locations and routing of conduits shall be governed by structural conditions and physical interference’s and by locations of electrical terminations on equipment.

1.09 REFERENCE DOCUMENTS

The Contractor shall refer to the Drawings, project data and shop drawings of other trades for additional details, which affect the proper installation of the work. Diagrams and symbols showing electrical connections are diagrammatic only, and so do not necessarily show the exact physical arrangement of the equipment.

1.10 SITE FAMILIARIZATION

Before submitting a bid, the Electrical Contractor shall become familiar with all features of the site, which may affect the execution of the work. The Contractor shall take all field measurements necessary for the work and shall assume full responsibility for their accuracy. The Contractor shall take full responsibility for locating and avoiding all substructures. Any damage to existing equipment shall be repaired or replaced by the Contractor at a cost negotiated with the Owner.

1.11 GROUND SYSTEM

A. Provide grounding and ground system per the NEC.

B. Construct metallic raceways to provide a continuous ground path.

C. Connect all electrical equipment enclosures to the ground system.

D. Nonelectrical equipment with metallic enclosures and metallic piping shall be connected to the grounding system as required by NEC.

E. Ground system shall be tested per IEEE standard 81. If greater than 2 ohms then additional ground rods shall be added and paid for as extra work.

F. Bond ground system to metallic piping as required by NEC.

G. Bond ground system to foundation steel in at least one location and at other locations as shown on the Drawings.

1.12 PRE-SUBMITTAL CONFERENCE

A. In addition to the Pre-construction Meeting, the Contractor shall arrange and conduct a Pre-submittal Conference within 30 Days after award of the Contract. The purpose of the Pre-submittal Conference is to review and approve the manner in which the Contractor intends to carry out its responsibilities for Electrical and I&C submittals and Shop Drawing submittals and the Work to be provided under Division 26 – Electrical and 40 – Process Interconnections specifications. The General Contractor, the Electrical Contractor, the System Integrator, and the Engineer shall attend. Both the Contractor and the Engineer may invite additional parties at their discretion.

B. The Contractor shall allot 4 hours (minimum) for the Conference. The conference shall take place at the Owner's office.

C. The Contractor shall present the following for discussion at the Conference:

1. Discussion of submittal documents and format.

2. Discussion of submittal schedule and critical path and long lead items and any concerns about lead times for any of the products.
3. A sample of submittal control wiring diagrams (equipment, instruments, PLC I/O cards) panel, equipment drawings to be provided.
4. A sample of each type of submittal.
5. A list of clarifications (RFQs) to the Contract Documents along with a brief explanation of each. Resolution shall be subject to a separate formal submittal and review by the Engineer.
6. Discussion of nameplates.
7. A list of proposed modifications, deviations from specified components and anticipated change orders.
8. Proposed shop and field testing procedures for electrical equipment and instrumentation and controls.
9. An overview of the proposed plan for maintaining the operations of the station during construction.
10. A preliminary schedule for the following activities:
    a. Electrical equipment submittals.
    b. Control Panel submittal.
    c. I&C submittal.
    d. Factory testing.
    e. Field I/O testing.
    f. Startup.
    g. System testing.

1.13 SUBMITTALS

A. Project data shall be submitted in accordance with the general requirements in Section 1-06.

B. Separate Submittals shall be provided for each specification section. All products for each spec section shall be included in a single PDF document including the cover sheet and index in **one single document**. Submittals shall be indexed and identified as follows:

1. Email subject line shall be “project name, EI&C submittal submittal #, spec section# - description.”
2. Cover sheet with:
    a. the project name and submittal #.
    b. Contractor's and sub-contractor’s name, phone number, and email address.
    c. index sheet showing each product being submitted.

3. 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 Sections 2.01 - 2.

4. Label each equipment submittal sheet with equipment name and number. Indicate location where each item of equipment submitted will be used on the job. Use equipment numbers when available.

5. Identify specific options and cross hatch out any information that is not a part of the specific information for the submitted component.

C. Submittals shall include the manufacturer's name, address, trade name, catalog model or number, nameplate data, size, layout dimensions, project specification and paragraph reference. Include other information necessary to establish contract compliance of each item proposed to furnish.

D. Long lead items may be submitted separately if pre-approved by the Engineer.

E. Each item shall be clearly marked and provided with adequate sales and technical information to clearly show conformance with all aspects of the specification. Packages not provided as described above or largely incomplete shall be returned to the Contractor, without comment.

F. I&C (Instrument & Control) submittals shall be provided with a Bill of Materials showing quantity, manufacturer's name, catalog number, and supplier name and phone number.

G. Certify on all submittals that the material being proposed conforms to the contract requirements. In the event of any variance, state specifically which portions vary and request a variance in writing.

H. Certify that all furnished equipment is able to be installed in the allocated spaces by stating on each item: "This equipment will be able to be installed in the spaces allocated."

I. Shop Drawings shall be provided on 11" x 17" sheets maximum size, and shall be scaled using standard engineering or architectural scales. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment.

J. NOTE: submittals received that do not meet the requirements outlined above and in the individual spec sections will be returned without review.

K. Contractor should anticipate in the schedule that submittals will take a minimum of 4 weeks for comments to return.

L. The engineer will have a minimum of 2 weeks to review (Division 26 – Electrical) submittals and a minimum of 3 weeks to review I&C (Division 40 – Process Interconnections) submittals.

PART 2 : PRODUCTS

2.01 THERMAL (TEMPERATURE) RATINGS OF EQUIPMENT TERMINATIONS

A. Wiring and circuit breakers on this project are designed for 75°C operation above 30 amperes; 60°C for 30 amperes and below.

B. All products furnished on this project shall have electrical terminations rated for 60°C for ampacities of 30 amperes or less and rated for 75°C for ampacities above 30 amperes.

PART 3 : EXECUTION

3.01 STORAGE AND INSTALLATION ENVIRONMENT

All electrical equipment shall be stored in a dry environment free from dust, moisture, sprays or vapors, which may be detrimental to their new condition. After installation of equipment, care shall be taken to protect all equipment from all dust, moisture, paint and other spray, harmful vapors, etc. until final acceptance and certificates of occupancy have been obtained.

3.02 SITE INSPECTIONS

A. Prior to final acceptance the Engineer will perform one or more site observation trips to develop a “punch list” of items deemed incomplete.

B. Each punch list item shall be completed by the Contractor and checked off of the list. When all of the items on the list are completed or commented on, the list shall be signed by the Contractor and returned to the Engineer for verification.

3.03 FINAL ACCEPTANCE

A. When all work is complete, the Contractor shall call the Engineer for the final acceptance testing inspections. The Electrical Contractor and System Integrator shall be present while these inspections are taking place and shall be available for opening cabinets and operating and adjusting the system as is necessary for the Engineer to verify all equipment is installed and operates to the requirements of the contract documents.

B. The contractor shall anticipate a minimum of 8 hours for each pump station to complete the final acceptance testing.

C. Prior to the Contractor calling for this observation, the Contractor shall have completed all items of work, including wire markers, nameplates, final tests and final test reports. All equipment shall be checked for proper operation and all signals verified for correct calibration and wiring.

D. Final acceptance will not be given until:

1. All work is complete.
2. All “site inspection” punch-lists are checked off and returned to the Engineer.

3. All test reports are received.
4. All O&M manuals are received.
5. All spare parts are received.
6. All instrument test forms are received.
7. All project record drawings are received.
8. All permits have been Signed-off and Finalized by WA L&I Electrical Inspector

3.04 PROJECT RECORD DRAWINGS

A set of drawings shall be maintained at the job site (by the Electrical Contractor) showing any deviations in the electrical systems from the original design. These drawings shall conform to the requirements for Project Record Drawings in Division 01.

3.05 GUARANTEE

The Contractor shall guarantee his work per the requirements in Division 01.

3.06 CLEANUP

A. The premises must be kept free of accumulated materials, rubbish and debris at all times. Surplus material, tools and equipment must not be stored at the job site. At the completion of the job, all equipment and fixtures shall be left clean and in proper condition for their intended use.

B. All motor control equipment and control panels shall be cleaned inside and out at the completion of the project.

3.07 TESTS

A. Testing for installed feeder cables and motors is required as specified in other Sections. Test reports shall be submitted to the Engineer prior to final acceptance. All tests shall be performed in accordance with the applicable sections of NETA.

B. Where specified in the individual product specification section, factory tests shall be performed at the place of fabrication and performed on completion of manufacture or assembly. The costs of factory tests shall be included in the contract price.

C. At any time sewage while sewage is pumped at the lift station, the Contractor shall provide and ensure alarm monitoring is available such that the Contractor and the Owner may be notified of conditions which may result in a sewage spill.

D. The following are critical alarm points that must remain operational during construction and shall be tested at least daily at the end of each working day.

1. Wet well high level float -. local alarm and autodialer/telemetry.
2. Pump fail – local alarm and autodialer/telemetry.
3. Power fail – autodialer/telemetry alarm.

E. All changes in pump stations operations shall be directly coordinated with the County. All power outages shall be coordinated with the County and the Utility.

F. The Contractor shall test the high level float and power fail alarms through the telemetry system every night before leaving the site and verify with the County office that the alarm is functioning. The telemetry must always be connected to a usable power source.

3.08 OPERATION AND MAINTENANCE MANUALS

The Contractor shall prepare and assemble detailed operation and maintenance and repair manuals as described in Division 01.

3.09 TRAINING

A. Training shall be provided per the specific requirements in other Sections of these specifications. In addition to training required in other Sections of the specifications, The Contractor shall conduct specifically organized training sessions in the overall operation and maintenance of the electrical system for personnel employed by the Owner. The training sessions shall be conducted to educate and train the personnel in operations and maintenance of all components of the electrical system outside the training requirements in the other Sections. 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. Equipment operation.

END OF SECTION

SECTION 26 05 00
MISCELLANEOUS ELECTRICAL

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This Section covers furnishing and installing miscellaneous electrical devices and equipment and other wiring devices indicated on the Drawings.

1.02 STANDARDS AND CODES

A. 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.

B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.

C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C.

1.03 COORDINATION

A. The Contractor is responsible for coordination of mechanical equipment, fans, louvers, heaters, motors, starters, etc. and the electrical power and control requirements. Provided in this Section and other Sections of the specifications and Drawings.

B. The Contractor shall provide power and control equipment, wiring, and raceways to meet the requirements of the mechanical equipment supplied.

C. The Contractor shall verify as a minimum:

1. Correct voltage, phase and frequency.
2. Correct motor starter type.
3. Proper coordination with the controls and control system Integrator.

D. The Contractor shall provide all necessary control wiring and components for any special requirements from an equipment manufacturer.

E. Any discrepancies between the electrical and mechanical equipment shall be brought to the immediate attention of the Engineer.

1.04 SUBMITTALS

A. In accordance with the “submittals” requirements in Section 1-06 – Control of Materials and Section 26 00 00 – Electrical General, submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

B. A copy of this specification Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (√) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification Sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

C. Provide all electrical information – wire diagrams, terminal information and numbering and electrical / power data.

D. Include the material proposed for each piece of equipment.

PART 2 : PRODUCTS

2.01 GENERAL

A. All wiring shall be installed in raceways unless specifically noted otherwise.

B. GROUND CONDUCTOR

1. All raceways shall contain a minimum of one continuous copper equipment grounding conductor sized in accordance with the NEC.

2.02 AREA CLASSIFICATIONS:

A. The following classification of areas shall be used as a reference in determining application of material covered by this Section unless specifically shown otherwise on the Drawings. Areas which fall under two or more of the following classifications shall conform to the minimum requirements of all area classifications listed for those areas.

B. Hazardous area classifications are be defined by:

1. NEC Article 500, NFPA 820 for wastewater facilities, NFPA 497 for general hazardous area classification
2. Designation are approved by the authority having jurisdiction, generally the local fire marshal.

C. Limits shown on drawings or details are interpretations of classification and may include scaled depictions. Provide materials and methods suitable for Class I, Division 1 in areas identified as Class I, Division 1. Provide materials and methods suitable for Class I, Division 2 in areas identified as Class I, Division 2.

D. HAZARDOUS AREAS

1. Hazardous areas shall have electrical installations which conform to Class and Division as shown on the Drawings or as defined by the NEC and NFPA 820. Provide seal fittings as required by NEC.
2. Raceway supports such as channel, clamps and brackets shall be 316 stainless steel. Threaded fastening hardware and rods shall be 316 stainless steel. Provide galvanic isolation barrier between aluminum conduit and support channels.
3. Equipment and products used shall be provided and installed in conformance to the applicable sections of NEC Chapter 5.

E. WET AND DAMP AREAS

1. All outdoor areas are wet.
2. Conduit entrances shall be threaded and fittings shall have gasketed covers.
3. Threaded fastening hardware and rods shall be 316 stainless steel.
4. Raceway supports, such as channel, channel clamps, and brackets, shall be 316 stainless steel or aluminum or non-metallic.
5. Provide galvanic isolation barriers or solution applications to prevent corrosion by dissimilar metals.
6. Panels and boxes shall be NEMA 3R - aluminum, 316 stainless steel or non-metallic (or as shown on the Drawings).
7. Device boxes shall be cast, copper free aluminum.
8. Provide galvanic isolation barriers or solution applications to prevent corrosion by dissimilar metals.

F. DAMP AREAS

1. Threaded fastening hardware and rods shall be stainless steel or steel.
2. Raceway supports, such as channel, channel clamps, and brackets, shall be stainless steel or Aluminum.
3. Provide galvanic isolation barriers or solution applications to prevent corrosion by dissimilar metals.

G. CORROSIVE AREAS

1. Provide 316 stainless steel raceway supports such as channel, clamps and brackets .
2. Threaded fastening hardware and rods shall be 316 stainless steel. Provide galvanic isolation barriers or solution applications to prevent corrosion by dissimilar metals.
3. Enclosures shall be NEMA 4X 316 stainless steel, aluminum or non-metallic (or as shown on the Drawings). Provide galvanic isolation barriers or solution applications to prevent corrosion by dissimilar metals.

H. DRY INDOOR AREAS

1. Same as damp application raceway application.
2. General electrical materials.

I. AREA TABLE

1. Unless noted otherwise, the following describe the minimum materials.

Site	Area	Class I, Division 1	Class I, Division 2	Corrosive	Wet	Damp	Dry
PS19	Wet Well	X		X	X		
PS19	Engine Room			X		X	
PS19	Valve Room			X	X		
PS19	Electrical Room						X
PS19	Fuel Area		X		X		
PS19	Odor Control		X	X	X		
PS31	Wet Well	X		X	X		
PS31	Valve Vault		X	X	X		

2.03 MOTORS

A. GENERAL

1. Unless specifically excepted, all motors shall be "premium energy efficient" type or higher efficiency which meet the minimum efficiencies required by the Washington State energy codes.
   a. All Motors shall be suitable both electrically and mechanically to drive the connected equipment under any and all modes of operation without exceeding the FLA (Full Load Amps) rating of the motor.
2. All motors shall be suitable for the environment in which they are to be installed. The environment in which motors will be installed in this project will be 100% humidity continuously.
3. Motor voltages shall be chosen to meet the requirements of the electrical system. The Contractor shall choose the motor voltages to meet what is shown on the Drawings.
4. Motor enclosures shall be totally enclosed fan cooled (TEFC) unless otherwise specified or required by the environment installed. Provide explosion proof non-ventilated - (XPNV) or fan cooled (XPFC) motors in hazardous areas.
5. All single-phase motors shall be self-protected. Single phase motors shall be provided with start capacitors if necessary for proper operation of the motor. The start capacitors shall be located within the motor housing.
6. Enclosed Motors: Provide drain plugs for non-explosion proof motors and drain and breather for explosion proof motors.

7. Finish: Provide a prime and final finish of the manufacturer's standard colors.

8. Provide imbedded thermostats for thermal alarm or motor cut out for all motors 40 Hp and above unless otherwise shown.

9. Provide a terminal connection box two sizes larger than normal to allow extra room for motor feeder splices. Refer to Motor Terminal Splice Insulation requirements.

10. Provide NEMA Class B insulation, minimum, with additional nonhygroscopic moisture protection which will maintain a minimum resistance of 1.0 megohms after 168 hours of exposure at 100% humidity.

11. Provide motors with a 1.15 service factor at maximum motor operating load.

B. SUBMERSIBLE MOTORS

1. Definite purpose submersible motors shall conform to the following:

a. Motor shall be designed for service in a liquid temperature of 25 degrees centigrade. Set controls to permit operation only when fully submerged unless specifically rated for non submerged duty.

b. Motor shall have two mechanical seals; the lower one outside the motor and protecting the upper one which shall be in an oil filled chamber.

c. Provide imbedded thermostats for thermal alarm or motor cut-out.

d. Provide water detector probes in seal oil chamber.

e. Provide one or more multiconductor cables of approved construction and suitable length to extend from the motor to the indicated receptacle or junction box. Provide strain relief for the cable.

f. Separate cables shall be provided for power and alarm conductors.

g. Provide control wiring connection diagram and all necessary components, relays, etc. for the required and proper control and shutdown of the motor. Provide descriptive information to the Engineer and System Integrator on the control of the equipment.

2.04 HARDWARE

A. The Contractor shall provide any necessary hardware for mounting equipment and devices.

B. The mounting hardware shall be made of materials suitable for the environment installed.

C. Provide materials made from aluminum, non-metallic, or 316 stainless steel in outdoor, damp, or corrosive areas.

PART 3 : EXECUTION

3.01 GENERAL

A. Provide services of an authorized representative of manufacturer to visit site of work and inspect, check, adjust if necessary, and approve equipment installation.

B. Assure that equipment manufacturer's representative is present when equipment is placed in operation.

C. Verify that equipment representative revisits job site as often as necessary until all trouble is corrected and equipment installation and operation are satisfactory, in opinion of Engineer.

D. Verify that motor overcurrent protection is in accordance with the N.E.C.

E. Verify the motor protection and control is in accordance with the equipment manufacturers requirements.

3.02 HAZARDOUS AREA SEALING

SEALING OF CONDUIT: Conduits passing from a hazardous or corrosive area into a nonhazardous or noncorrosive area, or between Class 1, Division 1 area and Class 1, Division 2 area shall be provided with a sealing fitting which shall be located at the boundary in accordance with NEC.

3.03 WIRE AND TERMINAL MARKING

A. TERMINAL MARKING

1. All terminals in instrument and relay compartments, motor control centers, in control panels, instrument panels, field panels and control stations, as well as connections to mechanical equipment shall have reference number and letter in accordance to the following:
    a. h = Control power hot (usually 120v or 24v)
    b. n = neutral
    c. g = ground
    d. c = control (use if none of the above letters apply)
    e. p = power (usually 480v)
    f. s = signal (usually 4-20ma or 1-5v) (use if none of the above letters apply)
    g. B = DC + and –
2. PLC input or output (S=slot number and I = card input number: for example slot 3 input 7 = 3-07).

B. WIRE MARKING

1. All power and control conductors shall be tagged; including conductors in instrument and relay compartments of motor control centers, in control panels, instrument panels, field panels and control stations, as well as connections to mechanical equipment, shall be tagged at each end with legible, permanently coded tight fitting wire-marking sleeve showing the complete wire designation.
2. Wire marking lettering shall be bold and type written.
3. Wiring within a single enclosure shall be marked with the basic wire and terminal number at each end.
4. Control and signal wires that interface to PLC I/O shall be marked so that the number relates to the PLC slot and I/O number – this is the same number as the terminal number.
5. All field wiring shall have wire labels at each end. The labels shall be marked with the output terminal number at the original equipment (control panel, MCP, RCP, LCP or MCC) or remote device terminal # (if applicable).
6. For wire that terminates in at a control panel at both ends or a control panel and an MCC, the priority for the numbering shall be as follows:

   a. MCP 2. RCP 3. MCC 4. LCP

END OF SECTION

ATTACHMENT: ELECTRICAL SYSTEM TEST REPORTS

ELECTRICAL SYSTEM TEST REPORT - 600V CABLE

ELECTRICAL SYSTEM
DESCRIPTION DATA

SERVICE DESCRIPTION:
nominal voltage, phase to phase
phase to neutral - single or three phase-
number of conductors _____

SERVICE CONDUCTORS:
phase size and insulation type _____
neutral size and insulation type _____
ground size and insulation type _____

SERVICE DISCONNECT DESCRIPTION:
circuit breaker or disconnect switch _____
size (amps) _____
fuse (amps) _____

MEASURED CONDITIONS		DATA
Operating Load Voltage	Volts	Vab_____ Vbc_____ Vca_____
		Van_____ Vbn_____ Vcn_____
Operating Load Feeder Current	Amps	Ia_____ Ib_____ Ic_____
Conductor Insulation Resistance (record the indicated measurement for each of the following circuits:)	Megohms	a-b_____ b-c_____ c-a_____
	Megohms	a-g_____ b-g_____ c-g_____

1. Service Feeder
2. Pump Feeders

MOTOR DATA AND TEST REPORT

EQUIPMENT NAME AND NUMBER: _____

EQUIPMENT SPECIFICATION SECTION: _____

MOTOR STARTER LOCATION _____

CONTRACTORS REPRESENTATIVE _____ DATE _____

MOTOR NAMEPLATE DATA

MFR Name/Model No. _____
Voltage/Phase/HP _____
FLA/LRA _____
Service Factor _____
Efficiency Index (or percent) _____
NEMA Design _____
Code Letter _____
Insulation Type _____
Temperature Rise _____
Ambient Temperature _____
RPM _____
Enclosure _____
Thermal Trip Setting _____
Space HTR: Watts/Volts _____
Other Data _____

MOTOR STARTER INFORMATION
Manufacturer/Type _____
Overload Heater No _____

* RECORDED FULL LOAD DATA	VOLTS	A-G_____	B-G_____	C-G_____	
FULL LOAD OPERATING VOLTAGE	VOLTS	A-B_____	B-C_____	C-A_____	
FULL LOAD OPERATING CURRENT	AMPS	A_____	B_____	C_____	
INSULATION RESISTANCE (deenergized)	MEGOHMS	A-G_____	B-G_____	C-G_____	
MOTOR CIRCUIT RESISTANCE	OHMS	A-B_____	B-C_____	C-A_____	

* VOLTAGE & CURRENT READINGS SHALL BE TAKEN AT THE CLOSEST ACCESSIBLE POINT TO THE LOAD

END OF SECTION

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SECTION 26 05 19
CONDUCTORS AND CABLES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. UTP cables and hardware for telecommunications.

1.02 DEFINITIONS

A. ANSI: American National Standards Institute

B. AWG or #: American Wire Gauge

C. /C: Conductor(s)

D. C: Conduit

E. G: Ground

F. ISO: International Standards Organization

G. N: Neutral

H. NEC: National Fire Protection Association Standard 70 (National Electrical Code)

I. NFPA: National Fire Protection Association

J. SHL'D: Shielded or screened

K. STP: Shielded, twisted pair

L. TIA: Telecommunications Industry Association

M. UTP: Un-shielded, twisted pair (Category 6 unless noted otherwise)

N. Other cable and wire definitions contained within National Fire Protection Association standard 70 (National Electrical Code).

O. Cable designations in general follow the formats:

1. For single conductors, 1#3/0N
   a. The first number, e.g., 1, refers to the quantity.
   b. The second grouping, e.g., 3/0, refers to the size of conductor as described in NEC Chapter 3.

c. Following the size of conductor are modifiers:

1) N – Neutral

2) G – Ground

2. For jacketed conductors, 2/C#16STP where

a. The first number, e.g., 2, is the total number of conductors:

b. The second number, e.g., 16, is the wire gauge size

c. Following the second number are modifiers.

1) "Blank" – jacketed multiconductor cable

2) STP – shielded-twisted pair(s)

3) SHL'D – overall shielded or screened

4) VFD – symmetrical VFD cable

3. Communications Cables:

a. CAT: Category as described by standards ANSI/TIA/EIA-568-B

b. FT10: use 4/C#18STP

c. MODBUS: (aka EIA/TIA) RS-485 cable

d. UTP: Unshielded Twisted Pair, Cat6 unless otherwise noted

e. CAT6(FTP): Twisted Pair with overall cable shield, Cat6 unless otherwise noted

f. CAT6(STP): Shielded Twisted Pair, Cat6 unless otherwise noted

g. CAT6(600V): Twisted Pair with 600V rated jacket and overall shield, Cat6 unless otherwise noted

h. Cat5 or Cat5e: Category 5 Enhanced

i. Cat6: Category 6

1.03 REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Grounding electrode conductors are described in Section 26 05 26, Grounding and Bonding for Electrical Systems.

1.04 SUBMITTALS

A. In accordance with the requirements of Section 1-06, submit the following:

1. Product Data: For each type of product.

a. Submittals are not required for named materials listed in PART 2 unless noted otherwise.

1) Provide Submittal for RHH-2/RHW wire.

b. Submit single manufacturer for each paragraph. Submittals with more than one manufacturer for the same material will be rejected without further comment.

c. Provide a submittal for products to be substituted instead of materials named in PART 2.

2. Shop Drawings:

a. Cabling administration drawings and printouts.

b. Wiring diagrams to show typical wiring schematics, including the following:

1) Cross-connects.

2) Patch panels.

3) Patch cords.

c. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.

3. Field quality-control reports.

a. Testing reports as described in Section 26 08 13, Electrical Demonstration.

PART 2 : PRODUCTS

2.01 GENERAL

A. COPPER CONDUCTORS: Comply with NEMA WC 70/ICEA S-95-658.

1. Aluminum conductors are not acceptable.

B. Supply the same manufacturer and product line for each sub-paragraph (letter).

2.02 SINGLE INSULATED CONDUCTORS

A. INSULATED CONDUCTOR: Type XHHW, XHHW-2

1. Comply with NEMA WC 70/ICEA S-95-658

a. Class B Stranded

b. Class C Stranded

c. Solid Core

2. Meet UL-44, 600 Volt class insulation

3. Manufacturers:

a. Encore Wire: Superslick Elite

b. Southwire: SIMpull

B. INSULATED CONDUCTOR: Type THHN THHN-2-THWN-2

1. Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

a. Class B Stranded

b. Class C Stranded

c. Solid Core

2. Meet UL-44, 600 Volt class insulation

3. Manufacturers:

a. Encore Wire: Superslick Elite

b. SouthWire: SIMpull

C. INSULATED CONDUCTOR: Type USE-2, RHH / RHW-2

1. Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

a. Class B Stranded

b. Class C Stranded

c. Solid Core

2. Meet UL-44 and UL-1581, 600 Volt class insulation

3. Manufacturers:

a. Encore Wire: Superslick Elite

b. SouthWire: SIMpull

2.03 SIGNAL CABLE

A. TRAY CABLE TYPE TC OR TC-ER (300V)

1. Shielded Signal conductor cable shall be AWG #16 individually twisted, shielded pairs unless noted otherwise.

2. Conductors shall be tinned copper with color coded 90 degrees C PVC insulation and individual conductor jacket of nylon.

3. Shielding shall be aluminum polyester 100% shield coverage with drain wire.

4. The cable shall have an overall PVC jacket. Provide Plenum rated jacket if noted or required.

5. The insulation system shall be rated for at least 300 volts.

6. Manufacturer:

a. Belden:

b. Encore: Type TC – Control or Instrumentation.

B. TRAY CABLE TYPE TC OR TC-ER (600V)

1. Shielded Signal conductor cable shall be AWG #16 individually twisted, shielded pairs unless noted otherwise.

2. Conductors shall be tinned copper with color coded 90 degrees C PVC insulation and individual conductor jacket of nylon.
    a. Conductor colors shall be Black and white.
    b. Each pair (if multi-pair cable is used) shall be identified at regular markings on the pairs or individual conductors.
3. Shielding shall be aluminum polyester 100% shield coverage with drain wire.
4. The cable shall have an overall PVC jacket. Provide Plenum rated jacket if noted or required.
5. The insulation system shall be rated for at least 600 volts.
6. Manufacturer:
    a. Belden:
    b. Encore: Type TC – Control or Instrumentation.

C. NETWORK COMMUNICATIONS CABLE

1. Ethernet Communications Network; Cable shall meet or exceed ANSI/TIA-568-C.2 “Category 6” cabling. Manufacturers as follows:
    a. Belden,
    b. Mohawk,
    c. Superior Essex
2. Provide Cat-6 compliant field termination plug kits, Belden DataTuff Industrial Ethernet Ruggedized RJ45 Plug Kit or equal. Field crimp, plastic shell RJ45 type plugs are not acceptable.

2.04 SPECIALTY COMMUNICATIONS CABLE

A. Provide specialty cable compatible with the control or communications system designated.

B. MODBUS cable shall be three conductor, one pair plus common plug overall shield with drain wire, nominal 120Ω resistance, low capacitance cable, NEC Type PLTC and NEC Type CM, characterized for frequency up to 10 mega-Hertz.

C. FTT10 cable shall be 2/C#16, NEC Type CM, compatible with Echelon TP/FT-10:

1. (NEMA) Level IV, 22AWG
2. TIA CAT5
3. Belden 85102
4. Belden 8471

2.05 COMMUNICATIONS CABLING

A. GENERAL

1. Data network and voice communications cabling shall comprise the Telecommunications Distribution System. The definitions for telecommunications cabling, such as horizontal cabling and backbone cabling, shall match BICSI Telecommunications Distribution Methods Manual (TDMM) .

B. TELECOMMUNICATIONS HORIZONTAL CABLING

1. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment consolidation point or room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
    a. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
    b. Bridged taps and splices shall not be installed in the horizontal cabling.
    c. Splitters shall not be installed as part of the optical fiber cabling.
2. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

C. TELECOMMUNICATIONS PERFORMANCE REQUIREMENTS

1. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.
2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    a. Flame-Spread Index: **25** or less.
    b. Smoke-Developed Index: **50** or less.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Grounding: Comply with J-STD-607-A.

D. UTP CABLE

1. Description: 100-ohm, four-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

a. Comply with ICEA S-90-661 for mechanical properties.

b. Comply with TIA/EIA-568-B.1 for performance specifications.

c. Comply with TIA/EIA-568-B.2, Category 6.

d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

1) Communications, General Purpose: Type CM or CMG.

2) Communications, Plenum Rated: Type CMP, complying with NFPA 262.

3) Communications, Riser Rated: Type CMR, complying with UL 1666.

4) Communications, Limited Purpose: Type CMX.

5) Multipurpose: Type MP or MPG; or MPP or MPR.

6) Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.

7) Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

8) 600V: Type CM, CMX with 600V AWM jacked, overall shielded.

9) OSP: Type CM, CMX rated for direct burial

E. UTP CABLE HARDWARE

1. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

2. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

3. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

4. Number of Terminals per Field: One for each conductor in assigned cables.

5. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

6. Number of Jacks per Field: One for each four-pair UTP cable indicated.

7. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

8. Patch Cords: Factory-made, four-pair cables in 36-inch and 120-inch lengths; terminated with eight-position modular plug at each end.
    a. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
    b. Patch cords shall have color-coded boots for circuit identification.
    c. Provide one 36-inch and 120-inch length patch cord for each cable shown.

F. TELECOMMUNICATIONS OUTLET/CONNECTORS

1. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
2. Workstation Outlets: Two-port-connector assemblies mounted in multigang faceplate.
    a. Metal Faceplate: Stainless steel compatible with Horizontal connectors.
    b. Legend: Machine printed, in the field, using adhesive-tape label.

2.06 VFD CABLE

A. Provide symmetrical VFD cable with overall shield and full size (total ground cross section must be 100% of a phase conductor) ground.

1. Cable shall meet UL 1277.
2. 600 or 1000 volt rated

B. Conductors shall be tinned with Class B or Class C stranding.

C. The conductor shall have an XLPE insulation jacket and the cable shall have an overall sunlight resistant PVC jacket.

D. Cable must be NEC TC and TC-ER rated.

E. Manufactured by

1. Belden
2. Alpha Cable Company

2.07 DEVICE MANUFACTURER CABLE

See requirements of devices section.

2.08 CONNECTORS AND SPLICES

A. DESCRIPTION: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

B. All wiring shall be continuous from point to point – no splices of any kind are allowed. All control and signal wire shall land on numbered terminals.

C. Ideal Industries "Wing Nut" or 3M Company "SCOTCHLOCK" pre-insulated connectors may be used for general purpose lighting and receptacle circuits for splices and taps in conductors No. 10 AWG and smaller. For No. 8 AWG and larger conductors, utilize T&B compression connectors. Compress using recommended die and tools.

D. For connections of wire to cord to removable equipment provided with integral cords (such as floats, transmitters, limit switches, aerators, submersible pump motors, etc.) Provide junction box with terminals and spade/lug type terminations and coat with liquid insulation – Performix Liquid Tape or approved equal.

E. For connections of wire to cord to submersible or immersible motors of all size wire use a water proof motor stub insulator. Thomas and Betts multi splice insulator MSLT112-4 or approved equal.

F. Splice insulation shall be equal to the conductor utilized. Insulate all permanent splices that are underground or in damp or corrosive environments with cast epoxy type insulation which covers the jacket of all cords and the insulation on all wire. Epoxy splice shall be Scotch #3570 or approved equal.

G. Provide motor terminal splice insulation in the motor connection box that will withstand constant vibration and abrasion without degrading the insulation of the splice. A product shall be used that is specifically designed for the purpose of motor terminations.

PART 3 : EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. FEEDERS

1. Copper.
2. Solid for No. 10 AWG and smaller; Class B stranded for No. 8 AWG and larger.

B. BRANCH CIRCUITS

1. Copper.
2. LIGHT AND RECEPTACLE Solid for No. 10 AWG and smaller; Class B stranded for No. 8 AWG and larger.
3. SIGNAL AND CONTROL BRANCH: Class C stranded.
4. Unless noted otherwise, provide Class B stranded.

3.02 CONDUCTOR INSULATION AND WIRING METHODS

A. SERVICE ENTRANCE: Type RHW/RHH-2, single conductors in raceway unless other type is required by Electrical Power Utility.

B. FEEDERS: Type XHHW-2, single conductors in raceway.

C. SIGNAL AND BRANCH CIRCUITS

1. Lighting and Receptacle power and controls where completely above grade and exposed for entire length: Type THHN-2-THWN-2, single conductors in raceway.
2. Power and controls: Type XHHW-2, single conductors in raceway.
3. Motor branch: Type XHHW-2, single conductors in raceway unless noted otherwise.
4. Signal and Communications: Type XHHW-2, single conductors

D. VFD CABLE APPLICATION: Use VFD cable for application between power supply, VFD drives, and motors including between disconnect switches, line filters, reactors, and motor protective devices. Cable shall be continuous and without splices.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Splices in power and control and signal wires or cables is not allowed. All wire transitions shall be done on terminals.

B. Keep all conductors within the allowable tension limits during installation. Lubricants for wire pulling, if used, shall be approved for the insulation and raceway material. Observe cable manufacturer's and industry standard cable bending radius recommendations.

C. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

D. Complete raceway installation between conductor and cable termination points prior to pulling conductors and cables.

E. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

F. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

G. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

H. JUNCTION BOX WITH TERMINALS

1. For circuits used for signaling and controls, it is acceptable to combine one or more circuits into common raceways. (In other words, do not combine power branch or feeder circuits unless explicitly noted.)
2. Do not route circuits with voltages higher than 48 volts to ground
   a. Circuits which are NEC 725 Class 1, Class 2, or Class 3 are acceptable as long as they have voltages less than 200 volts to ground.

3. Each conductor shall connect to a terminal in the junction box.

    a. Fiber optic or Category 5e or 6 ethernet cabling shall not terminate in a junction box with terminals unless explicitly noted.

4. Each conductor shall be labeled within 3 inches of termination.

5. Intrinsically safe circuits shall be separated by at least 2 inches from non-intrinsically safe circuits.

I. Size wire per NEC requirements for the load being served. Size raceways per NEC for the wire or cables installed. Upsize conduits if required. Scheduled raceways and wire sizes are minimum size.

J. Size pull and terminal boxes per NEC. Pull box sizes, if shown on the Drawings, are minimum size and the contractor shall upsize if required by NEC.

K. INSTRUMENTATION CABLE APPLICATION: bond or jumper shielding drain wires.

L. Provide connections for all devices indicated in the plans or included within panels or control systems.

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Terminate power conductors, 8 AWG and larger on box-type lugs.

D. Solid conductors (when allowed for lighting and receptacle circuits) of #10 and #12 may be directly terminated to screw terminals.

E. Provide spade or ring tongue type terminations for any power, control, or signal wire terminating on screw type terminals blocks.

F. Stranded control conductors may be directly terminated in terminal block type terminals at control panels. Insulated terminals shall be used also on all stranded instrumentation wiring.

G. Terminal boxes shall be provided at instrument cable splices. If cable is buried or in raceway below grade at splice, an instrument stand shall be provided as specified with terminal box mounted approximately 3 feet above grade.

H. Special instrumentation cables shall be terminated in accordance with the recommendations of the manufacturer of the equipment and subject to review by the Engineer.

I. No splices shall be used in power, control and/or signal wiring. The wiring shall be continuous from point-to-point. Extending existing cables will not be allowed except where shown on the Drawings.

3.05 INSTALLATION OF TELECOMMUNICATION CABLES

A. Comply with NECA 1.

B. GENERAL REQUIREMENTS FOR CABLING

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
   a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
   b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
5. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
12. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP CABLE INSTALLATION

1. Comply with TIA/EIA-568-B.2.

2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

3.06 IDENTIFICATION

A. Label in accordance with Section 26 05 53, Identification for Electrical Systems.

B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

C. Label circuits within 12 inches of terminal or lug, entrance to an enclosure, conduit bodies, or where accessible.

1. Phases shall be indicated by electrical tape.

a. Circuits at voltages higher than 240 to ground (i.e., 480/277Y) shall be indicated by jacket color. For conductors AWG#4 or larger, it is acceptable to use electrical tape to indicate phases.

1) Phase A: Brown

2) Phase B: Orange

3) Phase C: Yellow

4) Neutral: Gray

5) Ground: Green or Green/Yellow

b. Circuits at voltages of 240 or less to ground circuits shall be indicated by jacket color. For conductors AWG#4 or larger, it is acceptable to use electrical tape to indicate phases.

1) Phase A: Black

2) Phase B: Red

3) Phase C: Blue

4) Neutral: White

5) Ground: Green or Green/Yellow

c. Grounding electrode conductors or building grounding jumpers do not need to be labeled.

2. Telecommunications bonding backbones shall include a label, “TELECOM BONDING BACKBONE – DO NOT DISCONECT”.

D. The labeling scheme shall indicate the source device and final device with letters or numbers to generate unique identifiers. For example, “GEN-500—CP-6-A,1” may be used for a conductor between an engine generator and control panel. Multi-conductor cables may be labeled on the jacket instead of individual conductors. Where polarity is indicated, mark the positive conductor with “+” and the common or negative with “-”.

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. TEST AND INSPECTION REPORTS: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

3.08 SOURCE QUALITY CONTROL

A. TESTING AGENCY: **Engage** a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.09 CIRCUIT SCHEDULES

A. Circuit schedules may include circuits not shown elsewhere and are in addition to the information shown on drawings.

B. Provide the conductors as required for the Owner-furnished and vendor furnished systems.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This section includes grounding and bonding systems and equipment.

1.02 SUBMITTALS

A. In accordance with the requirements of Section 1-06, submit the following:

1. Action Submittals
    a. Product Data: For each type of product indicated.
    b. Submit single manufacturer for each paragraph. Submittals with more than one manufacturer for the same material will be rejected without further comment.
    c. Provide a submittal for products to be substituted instead of materials named in PART 2.
    d. Submittals are not required for named materials listed in PART 2.
2. Informational Submittals
    a. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
        1) Test wells.
        2) Ground rods.
        3) Ground rings.
        4) Grounding arrangements and connections for separately derived systems.
    b. Field quality-control reports.
3. Closeout Submittals
    a. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
        1) In addition to items specified in Section 1-06, Control of Work, Shop Drawings, Product Samples, and Operation and Maintenance Manuals, include the following:
            a) Instructions for periodic testing and inspection of grounding features at test wells and ground rings based on NETA MTS.

(1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.

(2) Include recommended testing intervals.

1.03 QUALITY ASSURANCE

A. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 : PRODUCTS

2.01 MANUFACTURERS

A. MANUFACTURERS: Subject to compliance with requirements, provide products by the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.02 SYSTEM DESCRIPTION

A. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.03 CONDUCTORS

A. INSULATED CONDUCTORS: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. BARE COPPER CONDUCTORS

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Conductor: Minimum No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.04 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. BOLTED CONNECTORS FOR CONDUCTORS AND PIPES: Copper or copper alloy.

C. WELDED CONNECTORS: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.05 GROUNDING ELECTRODES

GROUND RODS: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 : EXECUTION

3.01 APPLICATIONS

A. CONDUCTORS: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. UNDERGROUND GROUNDING CONDUCTORS: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.

C. CONDUCTOR TERMINATIONS AND CONNECTIONS

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.04 EQUIPMENT GROUNDING

Install insulated equipment grounding conductors with all feeders and branch circuits.

3.05 INSTALLATION

A. GROUNDING CONDUCTORS: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Construct metallic raceways to provide a continuous ground path.

C. GROUND RODS: Drive rods until tops are 24 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. TEST WELLS: Ground rod driven through drilled hole in bottom of handhole and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each generator unless otherwise indicated. Set top of test well flush with finished grade or floor.

E. BONDING STRAPS AND JUMPERS: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Bond ground system to metallic piping as required by NEC.

G. GROUND RING: Install a grounding conductor, electrically connected to each ground rod and to generator or tank frame, extending around the perimeter of generator and/or tank.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to generator/tank.

2. Bury ground ring not less than 24 inches (600 mm) from generator/tank foundation.

3. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. TESTS AND INSPECTIONS

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed 5 Ohms.

F. Ground system shall be tested per IEEE standard 81. If greater than 2 ohms, provide additional ground rods and connect to the building grounding electrode system.

G. EXCESSIVE GROUND RESISTANCE: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section covers hangers and supports for electrical cable, raceway, and devices and equipment.

B. Bracing and supports required under Section 26 05 48, Vibration and Seismic Controls for Electrical Systems, will be in addition to the requirements of this section.

1.02 REFERENCES

A. 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.

B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.

C. All materials and equipment specified herein, and their installation methods shall conform to the latest published version of the National Electric Code, NEC.

1.03 COORDINATION

A. The Contractor is responsible for coordination of mechanical equipment, fans, louvers, heaters, motors, starters, etc. and the electrical power and control requirements. Provided in this section and other Sections of the specifications and Drawings.

B. Any discrepancies between the electrical and mechanical equipment shall be brought to the immediate attention of the Engineer.

1.04 SUBMITTALS

A. In accordance with the requirements in Section 1-06 and Section 26 00 00, Electrical General, submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

B. A copy of this section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (√) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for

determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification Sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

C. Include the material proposed for each piece of equipment.

PART 2 : PRODUCTS

2.01 GENERAL

Provide systems recommended by electrical equipment manufacturers.

2.02 CONDUIT & CABLE SUPPORTS:

A. All fasteners between channel, strut, etc. and walls shall be removable with a screwdriver.

1. Rivet-type or Zamac fasteners are not allowed.

B. Support materials in general purpose areas may be hot-dip or electro-galvanized.

C. All support materials used in corrosive areas shall be Aluminum, 304 stainless steel, or non-metallic. Provide 304 stainless steel unless otherwise noted.

D. All screws, nuts, bolts and other hardware used with conduit and cable supports shall be 304 stainless steel.

2.03 HARDWARE

The Contractor shall provide any necessary hardware for mounting equipment and devices. The mounting hardware shall be made of materials suitable for the environment installed. Provide materials made from aluminum, non-metallic, or 316 stainless steel in outdoor, damp, or corrosive areas.

PART 3 : EXECUTION

3.01 GENERAL

A. Provide services of an authorized representative of manufacturer to visit site of work and inspect, check, adjust if necessary, and approve equipment installation.

B. Assure that equipment manufacturer's representative is present when equipment is placed in operation.

C. Verify that equipment representative revisits job site as often as necessary until all trouble is corrected and equipment installation and operation are satisfactory, in opinion of Engineer.

D. Install supports in accordance with manufacturer’s instructions.

E. Threaded fastening hardware and rods shall be stainless steel or steel. Raceway supports, such as channel, channel clamps, and brackets, shall be stainless steel or steel.

END OF SECTION

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SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

1.02 DEFINITIONS

A. AL-RMC: Rigid Metallic Conduit, Aluminum

B. EMT: Electrical Metallic Tubing

C. GRC: Galvanized rigid steel conduit, also RMC (Steel).

D. LFMC: Liquid-tight Flexible Metal Conduit

E. PVC: Polyvinyl-chloride, i.e., plastic.

F. PRMC: PVC Coated, Rigid (Aluminum) Metallic Conduit.

G. Per NEC Chapter 1 and Chapter 3.

1.03 SUBMITTALS

A. In accordance with the requirements of Section 1-06, submit the following:

1. Product Data:
    a. Where there are named manufacturer's and product lines, it is not necessary to submit for those materials.
    b. Submit only the material to be intended for use which differ from named manufacturer & product line per sub-paragraph. For example, submit on 2.01B if intending to use a manufacturer and product line not named.
        1) Submittals with more than one manufacturer for the same material will be returned without further review as "rejected".
        2) Submittals for materials with listed manufacturers will be a substitution request in lieu of materials from the listed manufacturers.
        3) Submittals are not required for using materials listed.

2. CIRCUIT GROUPING SCHEME: Show proposed routing plan of circuits based upon the grouping scheme developed under Section 26 05 19, Conductors and Cables.
    a. Provide footprint stub-up plan for switchboards, motor control centers, transfer switches, engine generators, and other floor mounted electrical equipment.
    b. Indicate the size, material, and conduit Tag ID.
    c. The plan shall show the following:
        1) Location of junction boxes with terminals
        2) Routing of the conduits to electrical distribution equipment, control panels, motor control centers, motor controllers.
        3) Routing of exposed conduits 2 inches or larger.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS

A. LISTING AND LABELING: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Use single manufacturer for all like materials of any size.

2.02 METALIC CONDUITS

A. ALUMINUM RIGID METALLIC CONDUIT (RMC)

1. Comply with ANSI C80.1 and UL 6.
2. Threaded fittings.
3. Material:
    a. Aluminum RMC (ALRMC): Shall be copper-free aluminum ANSI C80.5; aluminum
4. Manufacturers:
    a. Allied Tube & Conduit:
        1) Aluminum Rigid Conduit
        2) Kwiq-Couple is not acceptable
    b. Wheatland Tube:
        1) Rigid Aluminum Conduit
        2) Speed Couple is not acceptable

B. STAINLESS STEEL RIGID METALLIC CONDUIT (SST-RMC)

1. Comply with ANSI C80.1 and UL 6A.
2. Threaded fittings.

3. Material:
    a. Stainless Steel RMC (SSTRMC): Shall be 304-Grade stainless steel unless otherwise noted.
4. Manufacturers:
    a. Atkore International; Calbrite: Stainless Steel Rigid Conduit
    b. Gibson Stainless & Specialty Inc.; Stainless Steel Conduit

C. PVC-COATED RIGID METALLIC CONDUIT (PRMC): PVC-coated rigid aluminum conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.
3. Color:
    a. Black
    b. Light Blue for Intrinsically Safe Circuits
4. Manufacturers:
    a. Rob Roy Industries: PlastiBond
    b. Thomas and Betts: OCal

D. ELECTRICAL METALLIC TUBING (EMT)

1. Comply with ANSI C80.3 and UL 797.
2. Steel material.
3. Compression Fittings rated for continuous grounding through conduit. Set screw fittings are not acceptable.
4. Manufacturers:
    a. Allied Tube & Conduit: Electrical Metallic Tubing
    b. Wheatland Tube: Steel Electrical Metallic Tubing

E. ELECTRICAL METALLIC TUBING (EMT): Comply with ANSI C80.3 and UL 797.

1. Steel material.
2. Compression Fittings rated for continuous grounding through conduit.

F. LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT (LFMC): Flexible steel conduit with PVC jacket and complying with UL 360.

G. HAZARDOUS AREA SEAL-OFF CONDUIT BODIES: Seal fittings for conduit systems for hazardous atmosphere must be aluminum unless noted otherwise.

1. Sealing compound must be hard type, UL listed for explosionproof sealing fittings.
2. Sealing compound must be nonhardening type for corrosive areas.
3. Provide seal fitting and sealing compound from same manufacturer:

a. Appleton,

b. Crouse-Hinds.

2.03 FLEXIBLE CONDUIT

A. LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

(1) Flexible steel conduit with PVC jacket and complying with UL 360.

(2) Manufacturers:

(a) Anamet Electrical Inc.: Anaconda Sealtite Type UA

(b) Atkore: AFC Cable Systems: UL Liquid Tight Steel Conduit – TYPE LFMC

B. HAZARDOUS AREA FLEXIBLE METALLIC CONDUIT (FMC-EX)

(1) Manufacturers:

(a) Thomas and Betts: Kopex-Ex Metallic Hazardous Locations Flexible Conduit

2.04 FITTINGS FOR METAL CONDUIT

A. Comply with NEMA FB 1 and UL 514B.

B. Fittings for EMT:

1. Material: Steel.

2. Type: compression. Set-screw are not acceptable.

C. EXPANSION FITTINGS: PVC, aluminum, or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

D. COATING FOR FITTINGS FOR PVC-COATED CONDUIT: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

E. EXPANSION AND DEFLECTION JOINTS AND FITTINGS

1. O-Z Gedney "Type DX" or Crouse-Hinds "Type XD," bonded, weathertight expansion and deflection fitting of that conduit size.

F. JOINT COMPOUND FOR RMC (GRC): Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.05 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. LISTING AND LABELING: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RIGID NON-METALLIC CONDUIT (RNC): Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

1. Comply with NEMA TC 14 and UL 2420 for Below Ground and UL 2515 for Above Ground
2. Provide with extra-deep sockets where connected to raceway systems of different material.

D. FITTINGS FOR RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. MANUFACTURERS

1. Atkore: Allied Tube and Conduit: PVC Rigid Conduit
2. Cantex: Schedule 40 PVC Conduit

2.06 METAL WIREWAYS AND AUXILIARY GUTTERS

A. DESCRIPTION: Sheet metal, complying with UL 870 and NEMA 250, Type 12 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. FITTINGS AND ACCESSORIES: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. WIREWAY COVERS: Hinged type unless otherwise indicated.

D. FINISH: Manufacturer's standard enamel finish.

E. MANUFACTURER

1. Pentair: Hoffman
2. Ritall

2.07 BOXES, ENCLOSURES, AND CABINETS

A. GENERAL REQUIREMENTS FOR BOXES, ENCLOSURES, AND CABINETS: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

1. Materials for fittings shall be chosen to satisfy the requirements of - Area Classification described above.
2. Junction boxes, terminal boxes, device boxes, fixture support boxes, oblong, round and rectangular conduit fittings (condulets) shall be of the same material as required by the Area Classification for the raceway.

3. Boxes larger than 9”x9” shall be hinged.
4. Cast fittings and boxes shall be:
   a. Zinc electroplated cast ferrous alloy.
   b. Integrally cast threaded hubs or bosses shall be provided for all conduit entrances and shall provide for full 5 thread contact on tightening. Drilling and threading shall be done before finishing.
   c. The cover plate shall be of similar cast ferrous alloy material and finish. A full body neoprene gasket shall be provided with the cover. 316 stainless steel screws shall be provided for all covers.
5. All screws, nuts, bolts, and other hardware used with fittings and boxes shall be 316 stainless steel.
6. Provide galvanically isolating fittings where connecting conduit of a different metal to the enclosure.

B. SHEET METAL OUTLET AND DEVICE BOXES: Comply with NEMA OS 1 and UL 514A. Provide stamped boxes; welded boxes are not acceptable.

1. Eaton; Crouse Hinds: Device Box
2. Hubbel; Raco: Device Box

C. CAST-METAL OUTLET AND DEVICE BOXES: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover with matching material to the box.

1. Emerson; Appleton FD
2. Thomas and Betts: FD

D. NONMETALLIC OUTLET AND DEVICE BOXES: Comply with NEMA OS 2 and UL 514C.

E. LUMINAIRE OUTLET BOXES: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

1. Eaton; Crouse Hinds: Lighting Box
2. Hubbel; Raco: Lighting Box

F. SMALL SHEET METAL PULL AND JUNCTION BOXES: NEMA OS 1. Manufacturers as follows:

1. Eaton: B-Line
2. Pentair (Hoffman): nVent
3. ABB: Steel City

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. JUNCTION BOX WITH TERMINALS: Shall have a removable sub-panel to which terminals may be mounted. Enclosure shall have hinged doors with retained bolts for securing the cover. Provide white interior and sub-panel. Manufacturers as follows:

1. Eaton: B-Line
2. Pentair (Hoffman): nVent
3. ABB: Steel City

2.08 HAND HOLES AND VAULTS

A. Handholes and vaults shall be 24” X 36” X 36” minimum size or minimum dimensions as shown on Drawings. All handholes and vaults shall be minimum 3000 psi pre-cast, reinforced concrete construction and shall have concrete bottoms with sumps.

B. Walls shall be provided with boxouts with waterstops on all sides of each boxout. Boxouts shall be sized to accommodate the penetrating underground duct banks.

1. Waterproof duct sealing compound: Provide WATERGUARD Industrial Encapsulant or equal.

C. WIRE RACKS: Provide wire racks for all wiring inside handholes and vaults so that all wiring is supported above the bottom of the handhole.

D. Provide drain pipe for water tight covers from cover drain to nearest sump, drain, or as recommended by the manufacturer. If no drain area is nearby, provide a 3’ cubic area of drain rock and run cover drains to the area.

E. Wiring of different classes or that must be in separate raceway systems (in accordance with the NEC) in the same handhole shall be separated by continuing raceways inside the handhole and installing a non-metallic NEMA 4X pull box in the handhole.

F. Provide covers with hinged diamond plate galvanized steel, H-30 loading, and latch and lifting handles. Covers must open 180 degrees. Covers shall be chosen to fit the handhole or vault provided.

G. Manufacturers as follows:

1. Utility Vault Company
2. Oldcastle Precast

2.09 WARNING TAPE

Provide 6" width warning tape with wire tracer. Tape shall be labeled "WARNING ELECTRICAL".

2.10 CABLE SLEEVES

A. Shall be large enough to accommodate future conduit installation or armored cable installation.

B. Shall be constructed of aluminum schedule 40 pipe .

2.11 CORD SEALANTS

Provide water blocking, re-enterable conduit sealant for all circuits routing between dry areas, damp areas, wet areas, below grade, and outdoor areas. Provide sealant at terminal boxes, handholes, and conduit stub-up locations.

2.12 CONDUIT & CABLE SUPPORTS

A. Rivet-type or Zamac fasteners are not allowed. All fasteners between channel, strut, etc. and walls shall be removable with a screwdriver.

B. Support materials in general purpose areas may be hot-dip or electro-galvanized. All support materials used in corrosive areas shall be NEMA 4x Aluminum, 316 stainless steel, or non-metallic.

C. All screws, nuts, bolts and other hardware used with conduit and cable supports shall be 316 stainless steel.

2.13 CONDUIT BODIES

A. GENERAL

1. Materials for fittings shall be chosen to satisfy the requirements of Area Classification.
2. Conduit bodies shall be cast fittings.

B. Cast fittings and boxes shall be:

a. Zinc electroplated cast ferrous alloy.

b. Integrally cast threaded hubs or bosses shall be provided for all conduit entrances and shall provide for full 5 thread contact on tightening. Drilling and threading shall be done before finishing.

c. The cover plate shall be of similar cast ferrous alloy material and finish. A full body neoprene gasket shall be provided with the cover. 316 stainless steel screws shall be provided for all covers.

PART 3 : EXECUTION

3.01 GENERAL REQUIREMENTS

A. AREA CLASSIFICATIONS

1. The following classification of areas shall be used as a reference in determining application of material covered by this section unless specifically shown otherwise on the Drawings. Areas which fall under two or more of the following classifications shall conform to the minimum requirements of all of the area classifications listed for that area.
2. Hazardous area classifications shall be defined by:

a. NEC Article 500.

b. NFPA 30 for fuel facilities.

c. NFPA 820 for wastewater collection systems

3. Hazardous Areas:

a. Hazardous areas shall have electrical installations which conform to Class and Division as shown on the Drawings or as defined by the NEC and NFPA 30. Provide seal fittings as required by NEC.

b. Equipment and products used shall be provided and installed in conformance to the applicable sections of NEC Chapter 5.

B. RACEWAYS

1. Not all conduits/raceways are scheduled. Wire diagrams and oneline diagrams show wiring requirements. Provide all necessary raceways for wiring as shown on the Drawings.

2. For all power and control equipment, provide all necessary raceways and wire per Drawings and specifications even if not specifically shown on the Drawings.

3. Raceway routing shown on Drawings is general in nature, unless otherwise indicated on the Drawings, the Contractor shall be responsible for determining conduit routing that conforms to the installation requirements required by the Drawings and specifications.

4. The number of directional changes of a conduit shall be limited to 270 degrees in any run between pull boxes.

5. Conduit runs shall be limited to a maximum of 400 feet, less 100 feet or fraction thereof, for every 90 degrees of change in direction.

6. In general, conduit inside structures shall be exposed unless otherwise specified or indicated on the Drawings. No conduit shall be exposed in water chambers unless so indicated on the Drawings.

7. Provide raceways/conduits per the conduit and wire schedule and additional as necessary to meet the requirements of the wiring.

8. Scheduled conduit sizes are minimum. Contractor shall upsize conduits if necessary or if required by the NEC.

9. Non scheduled conduits shall be a minimum of ¾” or sized per the NEC for the wiring installed plus 20%.

10. Conduit across structural joints where structural movement is allowed shall have bonded, weathertight expansion and deflection fitting of that conduit size.

11. Separate conduits of different voltages by a minimum of 2” – separate signal wire conduits from all other types of conduits by a minimum of 6”.

12. All conduits shall be a minimum of 3/4".

13. Conduits entering underground structures must be made water tight – see “handholes and Vaults” for more requirements.

C. SEALING OF CONDUIT

1. Conduits passing from a hazardous or corrosive area into a nonhazardous or noncorrosive area, or between Class 1, Division 1 area and Class 1, Division 2 area shall be provided with a sealing fitting which shall be located at the boundary in accordance with NEC.
2. Seal fittings for conduit systems in hazardous atmosphere locations shall be aluminum. Sealing compound shall be hard type, UL listed for explosionproof sealing fittings. Sealing compound shall be nonhardening type for corrosive areas.

D. HANDHOLES AND VAULTS

1. Sizes of handholes and vaults shown on the Drawings are minimum sizes. If space allows the Contractor may upsize the structures for ease of pulling or if required by the NEC.
2. Conduits entering energized equipment shall have both conduit ends sealed with a waterproof duct sealing compound. Where conduits enter through sides of handholes the penetration shall be made watertight.
3. Provide a minimum of 12 inches of ¾ to 1” drainage gravel under entire surface of all vaults and handholes.
4. All wire installed in handholes and vaults shall be neatly bundled and racked to the handhole or vault side walls.
5. Provide welded 316 stainless steel nameplate on each handhole and vault cover with the tag number and contents (480v,120v, power, control, signal, etc.) clearly indicated.
6. Before final inspection, all vaults and handholes shall be cleaned and washed out with high pressure water to remove all dirt and debris. Clean sumps and knock-out sump plugs unless noted otherwise.
7. Provide drains from water tight lids to nearest sump, wet well, or provide a 3’ cubic drain area filled with drain gravel for draining handhole/vault covers.
8. Conduits entering substructures that contain electrical equipment shall first enter a Non Metallic junction box near the bottom of the box and then continue out of the top of the box to create a water break to stop water from entering electrical equipment – drill a ¼” weep hole in the junction box to drain away water.

3.02 RACEWAY APPLICATION

A. OUTDOORS: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: AL-RMC
2. Concealed Conduit Aboveground): AL-RMC.
3. Underground Conduit: RNC, RTRC, or PRMC
   a. Provide PRMC or RTRC for turns greater than 15º.

b. RNC turns 15º or greater and less than 15-foot radius are not acceptable.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

B. CORROSIVE AREAS

1. Exposed Conduit: PRMC (AL)

2. Concealed Conduit, Aboveground: AL-RMC.

3. Underground Conduit: RTRC, or PRMC

C. INDOORS: Apply raceway products as specified below unless otherwise indicated:

1. Exposed:

a. Unless noted otherwise, AL-RMC.

b. In the air-conditioned, climate controlled building only, where not subject to Physical Damage: EMT.

c. In or other Process Areas, and anywhere exposed and subject to Severe Physical Damage: AL-RMC.

d. Damp or Wet Locations: AL-RMC .

e. NEC 500 Hazardous Locations: AL-RMC .

f. Corrosive Locations: AL-RMC or SST RMC.

2. Concealed:

a. Unless otherwise noted: AL-RMC .

b. Above a dropped ceiling, or in the air-conditioned, climate controlled rooms only, where not subject to Physical Damage: AL-RMC.

c. Within concrete masonry unit (CMU) void spaces filled with grout or vermiculite: RNC, PRMC, or RTRC.

d. Damp or Wet Locations: AL-RMC or SST RMC.

e. NEC 500 Hazardous Locations: AL-RMC or Stainless Steel RMC.

f. Corrosive Locations: AL-RMC or SST RMC.

3. Enclosures shall be NEMA 4X 304 stainless steel unless noted otherwise.

4. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

5. Dry Indoor Areas:

a. Raceways, fastening hardware, conduit bodies, and junction boxes shall be steel.

b. EMT is acceptable for finished, mechanically climate-controlled areas.

D. VIBRATING EQUIPMENT

1. All connections to vibrating or moving devices, like transformers, float switches, and motors, must be one of the following unless noted otherwise:
   a. Single conductors in LFMC
   b. Single conductors in Hazardous area rated flex conduit (in Class I Areas)
   c. NEC TC-ER (Tray cable) rated cable with supports within 3 feet
   d. Manufacturer's integral and sealed cable.
2. Connections to equipment outdoors or in corrosive areas shall be with non-metallic liquidtight flexible conduit.

E. CONDUIT TURNS

1. Greater than 15 degrees:
   a. Outdoors: AL-RMC, PRMC, or SSTRMC
   b. Encased in CDF or Concrete encased duct bank: RNC or RFNC
   c. Transition into structural slab or to exposed: PRMC or SSTRMC: PRMC
2. 15 degrees for less:
   a. Concealed: AL-RMC, PRMC, or SSTRMC
   b. Exposed: AL-RMC

3.03 FITTINGS APPLICATION

A. RACEWAY FITTINGS: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20. Limit flexible conduit to 18 inches maximum straight connections unless otherwise indicated. Do not use flexible conduit for conduit turns, bends, or offsets.

B. CONDUIT TURNS: Provide fittings which match the connected conduit unless noted otherwise.

1. Provide fittings specifically designed for use if transitioning between different materials. (For example, between RFNC and PVC, or SSTRMC and RMC or PRMC.)

C. Provide galvantic isolation fittings if transitioning between different metals, such as AL-RMC, RMC (GRS), SSTRMC.

3.04 HANDHOLES AND VAULTS

A. Sizes of handholes and vaults shown on the Drawings are minimum sizes. If space allows the Contractor may upsize the structures for ease of pulling or if required by the NEC.

B. Conduits entering energized equipment shall have both conduit ends sealed with a waterproof duct sealing compound. Where conduits enter through sides of handholes the penetration shall be made watertight.

C. Provide a minimum of 12 inches of ¾ to 1" drainage gravel under entire surface of all vaults and handholes.

D. All wire installed in handholes and vaults shall be neatly bundled and racked to the handhole or vault side walls.

E. Provide welded 316 stainless steel nameplate on each handhole and vault cover with the tag number and contents (480v,120v, power, control, signal, etc.) clearly indicated.

F. Before final inspection, all vaults and handholes shall be cleaned and washed out with high pressure water to remove all dirt and debris and sumps shall be knocked out.

G. Provide drains from watertight lids to nearest sump, wet well, or provide a 3' cubic drain area filled with drain gravel for draining handhole/vault covers.

H. Conduits entering substructures that contain electrical equipment shall first enter a Non Metallic junction box near the bottom of the box and then continue out of the top of the box to create a water break to stop water from entering electrical equipment – drill a ¼" weep hole in the junction box to drain away water.

3.05 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Concealed conduit turns of anlges larger than 12º or less than 15 foot radius shall be FRPC or RMC; PVC turns are not acceptable.

C. MINIMUM RACEWAY SIZE: 3/4-inch (21-mm) trade size.

1. Provide minimum 1” for communications cables (e.g., building automation systems, control network fieldbus, or copper ethernet).
2. Provide minimum 2” for fiber optic communications conduits.
3. Unless noted otherwise, use only the following sizes for underground concealed conduits: 1”, 2”, 4”, 5”, 6”. In other words, do not use ¾ or 1 ½ inch trade size.

D. OUTDOOR AND DAMP AREAS

1. All outdoor areas.
    a. Conduit entrances shall be threaded and fittings shall have gasketed covers.
    b. Threaded fastening hardware and rods shall be 316 stainless steel. Raceway supports, such as channel, channel clamps, and brackets, shall be 316 stainless steel or aluminum or non-metallic. Provide galvanic isolation barriers or solution applications to prevent corrosion by dissimilar metals.
    c. Panels and boxes shall be NEMA 3R - aluminum, 316 stainless steel or non-metallic (or as shown on the Drawings). Device boxes shall be cast, copper free aluminum. Provide galvanic isolation barriers or solution applications to prevent corrosion by dissimilar metals.

E. RACEWAY FITTINGS: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Aluminum Rigid Metallic Conduits (Aluminum): Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

F. Keep raceways at least 6 inches (150 mm) away from generator exhaust pipes. Install horizontal raceway runs above water piping.

G. Complete raceway installation before starting conductor installation.

H. Comply with requirements in Section 26 05 48, Vibration and Seismic Controls for Electrical Systems, for hangers and supports.

I. Arrange stub-ups so curved portions of bends are not visible above finished slab.

J. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

K. Install conduits parallel or perpendicular to building lines.

L. Support conduit within 12 inches of enclosures to which attached.

M. THREADED CONDUIT JOINTS, EXPOSED TO WET, DAMP, CORROSIVE, OR OUTDOOR CONDITIONS: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

R. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

W. Separate conduits with intrinsically safe circuits from other raceways by at least 2 inches.

X. JUNCTION BOX WITH TERMINALS

1. Provide at least one 2 inch conduit from each junction box with terminals.
    a. Provide at least two for control panels; one conduit shall route discrete signals and the other shall route analog signals.
2. Increase conduit size if fill exceed 35% up to 4 inches. Provide multiple conduits if required.

3.06 INSTALLATION OF UNDERGROUND CONDUIT

A. DIRECT-BURIED CONDUIT

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as shown on drawings.
2. Install backfill as shown on drawings.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
4. Install manufactured rigid steel conduit elbows for stub-ups at equipment and at building entrances through floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Provide warning tape in all trenches, 12" above conduit or pipe.

3.07 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.08 LABELING

A. Label in accordance with Section 26 05 53, Identification for Electrical Systems.

B. Label conduits within 36 inches of wall penetrations, conduit bodies, and at least once every 30 feet where routed exposed.

C. The labeling scheme shall indicate the source device and intermediate or final destination with letters or numbers to generate unique identifiers. For example, “GEN-500—ATS-A-1” may be used for a conduit between an engine generator and automatic transfer switch.

3.09 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

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SECTION 26 05 48
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes seismic bracing for non-structural building electrical systems and appurtenances.

B. Section includes:

1. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.
5. Adhesive anchor bolts.

1.02 SUBMITTALS

A. In accordance with the requirements of Section 1-06, submit the following:

1. Action Submittals:
    a. Product Data: For each type of product.
        1) 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 as evaluated by an agency acceptable to authorities having jurisdiction.
            b) Annotate to indicate application of each product submitted and compliance with requirements.
    b. Delegated-Design Submittal: For each seismic-restraint device.
        1) Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
        2) Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.

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 spacings. 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.

2. Informational Submittals:

a. Qualification Data: For professional engineer and testing agency.

b. Field quality-control reports.

1.03 QUALITY ASSURANCE

A. TESTING AGENCY QUALIFICATIONS: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with NFPA 70.

PART 2 : PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Refer to Drawing S-1, Structural General Notes 1 of 2, for seismic performance requirements.

B. Use an importance factor (I_P) of 1.5 unless noted otherwise.

1. Lighting systems circuits may use an I_P of 1.0.

2. Convenience receptacle (e.g., NEMA 5-15R or 5-20R) may use an I_P of 1.0. Dedicated use receptacles must use an I_P of 1.5.

3. Surveillance and door open switch circuits and equipment may use an I_P of 1.0.

2.02 RESTRAINT CHANNEL BRACINGS

A. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:

1. International Seismic Application Technologies (ISAT)
2. Cooper B-Line, Inc.; a Division of Cooper Industries.
3. Hilti, Inc.
4. Mason Industries, Inc.
5. Unistrut; Atkore International.

B. DESCRIPTION: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.03 RESTRAINT CABLES

RESTRAINT CABLES: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.04 SEISMIC-RESTRAINT ACCESSORIES

A. HANGER-ROD STIFFENER: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

B. HINGED AND SWIVEL BRACE ATTACHMENTS: Multifunctional steel connectors for attaching hangers to rigid channel bracings.

C. BUSHINGS FOR FLOOR-MOUNTED EQUIPMENT ANCHOR BOLTS: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

D. BUSHING ASSEMBLIES FOR WALL-MOUNTED EQUIPMENT ANCHORAGE: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

E. RESILIENT ISOLATION WASHERS AND BUSHINGS: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.05 MECHANICAL ANCHOR BOLTS

MECHANICAL ANCHOR BOLTS: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.06 ADHESIVE ANCHOR BOLTS

ADHESIVE ANCHOR BOLTS: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. MULTIPLE RACEWAYS OR CABLES: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. HANGER-ROD STIFFENERS: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

C. STRENGTH OF SUPPORT AND SEISMIC-RESTRAINT ASSEMBLIES: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.03 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00, Cast-in-Place Concrete.

B. EQUIPMENT AND HANGER RESTRAINTS

1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. ATTACHMENT TO STRUCTURE: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. DRILLED-IN ANCHORS

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Engineer, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.

3. Obtain Engineer's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Engineer.

5. Test to 90 percent of rated proof load of device.

B. Seismic controls will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.06 ADJUSTING

Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.02 SUBMITTALS

PRODUCT DATA: For each electrical identification product indicated.

1.03 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.04 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.02 CONDUCTOR IDENTIFICATION MATERIALS

A. COLOR-CODING CONDUCTOR TAPE: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. SELF-ADHESIVE, SELF-LAMINATING POLYESTER LABELS: Preprinted, 3-mil-(0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

1. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

C. Field installed wire markers shall be pre-printed, heat shrink type sleeves, Thomas & Betts Type HVM, Tyton Type THS or accepted equal.

1. The letters and numbers that identify each wire shall be machine printed on sleeves with permanent black ink.
2. The figures shall be 1/8 inch high.
3. Sleeves shall be white tubing, sized to fit the conductor insulation. The sleeves shall be shrunk to fit the conductor with hot air after installation.

D. Write-on adhesive strips are not acceptable.

2.03 FLOOR MARKING TAPE

2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.04 UNDERGROUND-LINE WARNING TAPE

A. TAPE

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. COLOR AND PRINTING

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. TAG

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

2.05 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. SELF-ADHESIVE WARNING LABELS: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. BAKED-ENAMEL WARNING SIGNS

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.06 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.07 EQUIPMENT IDENTIFICATION LABELS

A. SELF-ADHESIVE, ENGRAVED, LAMINATED ACRYLIC OR MELAMINE LABEL: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

B. Nameplates shall be black laminated rigid phenolic with white core. Nameplate minimum size shall be 1 inch high by 3 inches long with 3/16-inch-high engraved white letters. Supply blank nameplates for spare units and spaces.

2.08 CABLE TIES

A. GENERAL-PURPOSE CABLE TIES: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. PAINT: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. FASTENERS FOR LABELS AND SIGNS: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

C. NAMEPLATE FASTENERS: Fasten nameplates to the front of equipment by means of stainless steel self-tapping screws and stick-on adhesives. Where nameplates may degrade the finish or integrity of the enclosure, weld nameplate holders to the equipment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. SELF-ADHESIVE IDENTIFICATION PRODUCTS: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. SYSTEM IDENTIFICATION COLOR-CODING BANDS FOR RACEWAYS AND CABLES: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. ALUMINUM WRAPAROUND MARKER LABELS AND METAL TAGS: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. UNDERGROUND-LINE WARNING TAPE: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

I. PAINTED IDENTIFICATION: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 EQUIPMENT AND DEVICE MARKING

A. DESIGNATIONS: Externally mark all equipment, devices, feeders, branch circuits and similar items with nameplates with the same designations as indicated on the Contract Documents.

B. In general, provide the following information for the types of electrical equipment as listed:

1. Individual Starters, Contactors, Disconnect Switches, Transfer Switches and Similar Equipment: Identify the device designation, voltage characteristics source and load served. Where fuses are installed, nameplate shall indicate switch rating and fuse size (i.e. 200A/150AF).
2. Panelboards: Identify panelboard designation (i.e.: name), voltage characteristics (e.g.: 208Y/120V 3ph, 4W), serving feeder/neutral ground size, quantity and type (e.g.: (2) sets 500, 350N, #3G CU) and source designation (e.g.: Source: MDP 1,3,5).
3. Pull boxes and Junction Boxes: With ½ inch high permanent lettering, identify conduits connected to pull, junction and outlet boxes with the complete circuit number of the conductors contained therein. Where multiple circuits are contained in a box, identify the circuit conductors with permanent tags which indicate circuit designation.
4. Fire alarm circuits (only) shall be marked with half red covers and circuit designation marked on the face.

C. Power receptacles, wall switches and dedicated outlets.

D. DEDICATED OUTLETS: Dedicated is understood to be specific equipment listed by equipment number in the panel schedules or identified on the Drawings.

E. REMOTE BALLASTS: For remote ballasts not within five (5) feet of their associated lighting fixture, provide appropriate permanent lettering on both the ballasts and the light fixture to identify which are mated to the other.

3.03 IDENTIFICATION SCHEDULE

A. Each power and control conductor shall be identified at each terminal to which it is connected.

1. Provide identification sleeves for conductors 10 AWG or smaller.
2. Identify conductors in accordance with Section 26 05 00 – Miscellaneous Electrical.

B. Conductors No. 8 AWG and larger shall use cable markers of the locking tab type. Tabs shall be white plastic with conductor identification number permanently embossed.

C. ACCESSIBLE RACEWAYS, ARMORED AND METAL-CLAD CABLES, MORE THAN 600 V: Snap-around labels. Install labels at 30-foot maximum intervals.

D. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

E. POWER-CIRCUIT CONDUCTOR IDENTIFICATION, 600 V OR LESS: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:

Phase A: Black.

Phase B: Red.

Phase C: Blue.

c. Colors for 480/277-V Circuits:

Phase A: Brown.

Phase B: Orange.

Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. POWER-CIRCUIT CONDUCTOR IDENTIFICATION, MORE THAN 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags.

G. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

H. CONTROL-CIRCUIT CONDUCTOR IDENTIFICATION: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.

I. AUXILIARY ELECTRICAL SYSTEMS CONDUCTOR IDENTIFICATION: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

J. LOCATIONS OF UNDERGROUND LINES: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

K. WORKSPACE INDICATION: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

L. WARNING LABELS FOR INDOOR CABINETS, BOXES, AND ENCLOSURES FOR POWER AND LIGHTING: Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
    a. Power transfer switches.
    b. Controls with external control power connections.

M. OPERATING INSTRUCTION SIGNS: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

N. EQUIPMENT IDENTIFICATION LABELS: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
    a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.

b. Enclosures and electrical cabinets.

c. Access doors and panels for concealed electrical items.

d. Switchboards.

e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

f. Motor-control centers.

g. Enclosed switches.

h. Enclosed circuit breakers.

i. Enclosed controllers.

j. Variable-frequency drives.

k. Push-button stations.

l. Power transfer equipment.

m. Contactors.

n. Remote-controlled switches, dimmer modules, and control devices.

o. Power-generating units.

p. Monitoring and control equipment.

END OF SECTION

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SECTION 26 05 73.13
SHORT CIRCUIT STUDY

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.02 DEFINITIONS

A. 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.

B. ONE-LINE DIAGRAM: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. PROTECTIVE DEVICE: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. SERVICE: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.03 ACTION SUBMITTALS

A. PRODUCT DATA: For computer software program to be used for studies.

B. OTHER ACTION SUBMITTALS: Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

1. Short-circuit study input data, including completed computer program input data sheets, in Tabular form. At a minimum, include the information described in IEEE 241 as necessary for completion of the Short-circuit study. In addition, provide the following information as well:
    a. Engine Generator protective relay trip curve.
    b. The motor circuit protector settings for the motors actually provided. (Coordinate with the equipment vendors for information on the driven equipment.)
    c. The motor full load amperes, power factor and locked rotor amperes or required starting current for each motor connected to a motor controller in a motor control center or standalone controller. (Coordinate with the equipment vendors for information on the driven equipment.)
2. Provide the electronic file, suitable for direct loading into the Short-circuit and equipment evaluation software suite.

3. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Engineer for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory with assumptions made to complete the preliminary study. Provide final Short-circuit study and evaluation report as soon as practicable. Do not energize equipment without an approved Short-circuit study and evaluation report.

    b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

    c. Revised time-current-characteristic curves showing each motor and at least two levels of protective devices above it. Multiple motors may reference the same TCC if more than one motor can be described by the same TCC. In other words, one TCC per grouping of motors is adequate if the motors have the same FLA, LRC, MCP settings, are connected to the same bus, etc.

1.04 INFORMATIONAL SUBMITTALS

A. QUALIFICATION DATA: For Short-Circuit Study Specialist.

B. PRODUCT CERTIFICATES: For short-circuit study software, certifying compliance with IEEE 399.

1.05 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. SHORT-CIRCUIT STUDY SPECIALIST QUALIFICATIONS: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

C. FIELD ADJUSTING AGENCY QUALIFICATIONS: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 : PRODUCTS

2.01 COMPUTER SOFTWARE

A. SOFTWARE DEVELOPERS: Subject to compliance with requirements, software by one of the following:

1. EasyPower, LLC.
2. SKM Systems Analysis, Inc.

B. Comply with IEEE 399 and IEEE 551.

C. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.02 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. PROTECTIVE DEVICE EVALUATION

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.

5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. SHORT-CIRCUIT STUDY INPUT DATA: As described in "Power System Data" Article in the Evaluations.

G. SHORT-CIRCUIT STUDY OUTPUT

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Equivalent impedance.
2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:
      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 1.6.
3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Obtain all data necessary for the conduct of the study.

1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Engineer.

2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

2. Obtain electrical power utility impedance at the service.

3. Power sources and ties.

4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.

5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.

6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.

7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.

8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.

9. Motor horsepower and NEMA MG 1 code letter designation.

10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.02 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

G. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:

1. Electric utility's supply termination point.
2. Incoming switchboard.
3. Motor-control centers.
4. Control panels.
5. Standby generators and automatic transfer switches.
6. Branch circuit panelboards.
7. Disconnect switches.
8. motor starters

3.03 ADJUSTING

Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.04 DEMONSTRATION

Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION

SECTION 26 05 73.16
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.02 DEFINITIONS

A. 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.

B. ONE-LINE DIAGRAM: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. PROTECTIVE DEVICE: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. SERVICE: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.03 ACTION SUBMITTALS

A. PRODUCT DATA: For computer software program to be used for studies.

B. OTHER ACTION SUBMITTALS: Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Engineer for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.04 INFORMATIONAL SUBMITTALS

A. QUALIFICATION DATA: For Coordination Study Software Developer, Coordination Study Specialist, Field Adjusting Agency.

B. PRODUCT CERTIFICATES: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.05 CLOSEOUT SUBMITTALS

A. OPERATION AND MAINTENANCE DATA: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 1-11 – Operation and Maintenance Data, include the following:

a. The following parts from the Protective Device Coordination Study Report:

1) One-line diagram.

2) Protective device coordination study.

3) Time-current coordination curves.

b. Power system data.

1.06 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. COORDINATION STUDY SOFTWARE DEVELOPER QUALIFICATIONS: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. COORDINATION STUDY SPECIALIST QUALIFICATIONS: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. FIELD ADJUSTING AGENCY QUALIFICATIONS: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 : PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. SOFTWARE DEVELOPERS: Subject to compliance with requirements, software by one of the following:

1. EasyPower, LLC.
2. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:
   a. Arcing faults.
   b. Simultaneous faults.
   c. Explicit negative sequence.
   d. Mutual coupling in zero sequence.

2.02 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. STUDY INPUT DATA: As described in "Power System Data" Article.

E. SHORT-CIRCUIT STUDY: As Specified in Section 26 05 73.13 – Short Circuit Study.

F. PROTECTIVE DEVICE COORDINATION STUDY

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
    a. Phase and Ground Relays:
        1) Device tag.
        2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
        3) Recommendations on improved relaying systems, if applicable.
    b. Circuit Breakers:
        1) Adjustable pickups and time delays (long time, short time, ground).
        2) Adjustable time-current characteristic.
        3) Adjustable instantaneous pickup.
        4) Recommendations on improved trip systems, if applicable.
    c. Fuses: Show current rating, voltage, and class.

G. TIME-CURRENT COORDINATION CURVES: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:
    a. Power utility's overcurrent protective device.
    b. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    c. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    d. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    e. Cables and conductors damage curves.
    f. Ground-fault protective devices.

g. Motor-starting characteristics and motor damage points.

h. Generator short-circuit decrement curve and generator damage point.

i. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Series rating on equipment allows the application of two series interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Both devices share in the interruption of the fault and selectivity is sacrificed at high fault levels. Maintain selectivity for tripping currents caused by overloads.

6. Provide adequate time margins between device characteristics such that selective operation is achieved.

7. Comments and recommendations for system improvements.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.02 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. TRANSFORMER PRIMARY OVERCURRENT PROTECTIVE DEVICES

1. Device shall not operate in response to the following:
    a. Inrush current when first energized.
    b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
    c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

G. MOTOR PROTECTION

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

H. CONDUCTOR PROTECTION: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

I. GENERATOR PROTECTION: Select protection according to manufacturer's written recommendations and to IEEE 242.

J. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

K. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Low-voltage switchboard.
3. Motor-control centers.
4. Standby generators and automatic transfer switches.
5. Branch circuit panelboards.
6. Motor starters.

L. PROTECTIVE DEVICE EVALUATION

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.

3.03 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.

B. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.04 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Engineer.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 241 and IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.

4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.

j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.

k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.05 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.06 DEMONSTRATION

A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.

2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.

3. Adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION

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SECTION 26 05 73.19
OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.02 DEFINITIONS

A. 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.

B. ONE-LINE DIAGRAM: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. PROTECTIVE DEVICE: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. SERVICE: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.03 ACTION SUBMITTALS

A. PRODUCT DATA: For computer software program to be used for studies.

B. OTHER ACTION SUBMITTALS: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form.

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.
    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Engineer for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.04 INFORMATIONAL SUBMITTALS

A. QUALIFICATION DATA: For Arc-Flash Study Specialist.

B. PRODUCT CERTIFICATES: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. OPERATION AND MAINTENANCE PROCEDURES: In addition to items specified in Section 1-11 – Operation and Maintenance Data, provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.06 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. ARC-FLASH STUDY SOFTWARE DEVELOPER QUALIFICATIONS: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. ARC-FLASH STUDY SPECIALIST QUALIFICATIONS: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. FIELD ADJUSTING AGENCY QUALIFICATIONS: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 : PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. SOFTWARE DEVELOPERS: Subject to compliance with requirements, provide software by one of the following:

1. EasyPower, LLC.
2. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.02 SHORT-CIRCUIT STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center and panelboard designations.

D. STUDY INPUT DATA: As described in "Power System Data" Article.

E. SHORT-CIRCUIT STUDY OUTPUT: Per Section 26 05 73.13 -Short Circuit Study.

2.03 ARC-FLASH WARNING LABELS

A. Produce a 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 : EXECUTION

3.01 EXAMINATION

Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.02 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems.

G. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Low-voltage switchboards.
3. Motor-control centers.
4. Standby generators and automatic transfer switches.
5. Branch circuit panelboards.
6. VFDs and motor starters

3.03 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Use the short-circuit study output and the field-verified settings of the overcurrent devices.

C. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include low-voltage equipment locations, except 240-V ac and 208-V ac systems fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.04 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on the one-line diagram on Drawings. Call discrepancies to the attention of Engineer.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, obtain any required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Gather and tabulate the following input data to support coordination study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
9. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
10. Motor horsepower and NEMA MG 1 code letter designation.
11. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
12. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.05 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:

1. Motor-control center.
2. Low-voltage switchboard.
3. Variable frequency drive and motor starter.
4. Control panels.

3.06 APPLICATION OF WARNING LABELS

Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.07 DEMONSTRATION

Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION

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SECTION 26 08 13
ELECTRICAL DEMONSTRATION

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section describes the general requirements for demonstration of the Control System in Factory Acceptance Tests, Field Loop Tests and Process Demonstration Tests.

B. The requirements of this section are above what is required by the Contractor's quality control system or other required testing demonstration.

C. The Contractor shall devise methods to demonstrate in accordance with the Contractor's safety plan and safe working procedures as determined by the Contractor. The Owner shall, at its option, witness the testing but shall not actively participate in the demonstration unless noted otherwise. Any correction, troubleshooting, or reprogramming is the responsibility of the Contractor.

D. Demonstration shall follow independent testing agency review and determination of acceptable working order and any Owner-witnessed control field loop testing. Demonstration shall precede unit operation demonstration for operational testing.

1. The Unit Operational testing shall include the minimum reliability for a single unit process. For example, a digester mixing loop may include two pumps and associated pressure switches, sludge level transmitter, flow meter, and valve actuators.

1.02 SECTION INCLUDES

A. Final control elements, instruments, controls, motors, and other process equipment for the unit processes comprise the demonstration.

B. Control panel demonstration specified under this section include:

1. Control Panel MCP
2. MTS

C. ELECTRICAL DISTRIBUTION SYSTEM

1. Reduced Voltage Soft Starters
    a. Pump 1 (Pump Station 19)
    b. Pump 2 (Pump Station 19)
    c. Pump 1 (Pump Station 31)
    d. Pump 2 (Pump Station 31)
2. Switchboards
    a. Main Circuit Breaker (Outdoor)

3. Manual Transfer Switch
    a. MTS A (Pump Station 19)
    b. MTS B (Pump Station 19)
    c. MTS (Pump Station 31)
4. Automatic Transfer Switch
    a. ATS LA1
5. Engine Generator
6. Engine Driven Pump

D. NETWORK COMMUNICATIONS SYSTEMS

1. Copper Communications Cable (horizontal cabling distributions)

1.03 REFERENCES

A. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

1. ICS 1, General Standards for Industrial Control and Systems.
2. ICS 4, Terminal Blocks for Industrial Use.
3. ICS 6, Enclosures for Industrial Controls and Systems.
4. Publication No.250, Enclosures for Electrical Equipment (1000 V maximum).

B. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1. National Electric Code (NEC).
2. Standard for Electrical Safety in the Workplace (NFPA 70E).

C. JOINT INDUSTRIAL COUNCIL

1. JIC-EMP-1.

1.04 SUBMITTALS

A. GENERAL: Submit each item in this Article in accordance with the requirement of Section 1.05.11 - Project Data Submittals, and Section 26 00 00 - Electrical General.

1. The System Integrator (defined in Section 40 61 13) shall supply the process control portions of the PLC program.

B. TEST PLAN

1. Field Loop: Submit proposed field loop testing plan a minimum of 20 days prior to first request for an Owner. It is acceptable to provide one submittal for similar instruments, such as pressure transmitters. Testing plan shall include any steps indicated in the execution of demonstration in addition to the normal quality control procedures of the Contractor.

Testing plan shall include tables and checklists for completion by the Contractor during the Owner witnessed field loop check.

2. Within 1 working day of the field loop test, submit the completed field testing plan.

C. PRODUCT SUBMITTALS: Unless noted otherwise, it is not necessary to provide submittals on materials or devices provided to aid in the requirements of this section.

D. TEST VERIFICATION LOG: Provide a master list of electrical equipment, devices, controllers, and control panels covered under this section. For each notification to the Owner for loop testing, provide the updated log showing the following:

1. Date in which the Contractor rehearsed the factory acceptance test,
2. Date the Owner witnessed factory acceptance test was requested,
3. The name of the person or persons representing the Owner and the date of the successful factory acceptance test,
4. For equipment tested by an independent testing agency (NETA), provide the date which the NETA agency determined the equipment to have no deviancies or corrections required.
5. Date in which the Contractor rehearsed the field loop test,
6. Date the Owner witnessed field loop test was requested,
7. The name of the person or persons representing the Owner and the date of the successful factory acceptance test.
8. Date the Owner witnessed automation demonstration was requested.
9. The name of the person or persons representing the Owner and the date of the successful automation demonstration.

1.05 QUALITY ASSURANCE

Submit and obtain approval of shop drawings and make approved shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with control panel access locations from approved shop drawings. Do not place conduits in slabs prior to the receipt of approved shop drawings. Any relocation of conduits that are required because of incorrectly placed conduits prior to receipt of approved shop drawings shall be completed at the Contractor's expense.

PART 2 : PRODUCTS

2.01 GENERAL

A. TESTING MATERIALS AND INSTRUMENTS

1. Provide testing materials as needed to demonstrate the functionality of the equipment described below.

2. Provide instruments, such as signal generators or test calibration references, to demonstrate the functionality of the equipment described below.

B. ENGINE GENERATOR FOR TESTING

1. Provide temporary engine generator to test portable engine generator connection. Provide connector which matches Owner equipment.
2. Provide fuel and other consumable products required for operating engine generator to testing.
3. Provide cables and connection kit required for interconnection.

PART 3 : EXECUTION

3.01 TESTING

A. GENERAL

1. Provide any temporary facilities required to affect the control system demonstration. Unless noted otherwise, remove temporary facilities used for demonstration within 48 hours of successful completion of demonstration.
2. Testing forms or checklists provided in these specifications supplement the Contractor's normal quality assurance testing procedures. Unless noted otherwise, it is acceptable to incorporate the tests enumerated on the testing forms or checklists into a larger procedure.
3. Correct, replace, or repair panel wiring, and/or components until testing demonstrates proper operation.

B. AUTOMATION SYSTEM TESTING

1. Unless noted otherwise, equipment shall be tested at the manufacturer's facility and certified to be in working order before shipment to the job site. The manufacturer may employ its quality assurance in addition to the automation testing requirements.
2. Do not ship panels to the site until testing has demonstrated satisfactory operation of the panels.
3. Provide updated and complete 'as shipped' drawings at the time of final testing. The Owner will review the drawings against the panel construction at the time of final testing. Drawings which do not reflect the actual construction of the panel will need to be revised and reviewed again by the Owner against the actual construction prior to shipment of the panel to the job site. 'As shipped' drawings which require revisions shall be submitted to the Owner for review at testing notification, prior to the actual field review of these drawings against the panel construction. This process of revision and review of the drawings will be repeated as necessary to produce drawings which reflect the actual construction of the panel at the time of shipment. Do not ship panels to the site until the 'as-shipped' drawings are updated, complete, and reflect the actual 'as-shipped' status of the panel.

C. SEQUENCE OF TESTING

1. Any required offsite testing shall occur before Contractor installs equipment onsite. The Contractor may perform additional tests in addition to the required tests.
2. After installation of equipment, the Contractor shall interconnect all devices.
    a. Electrical distribution equipment, such as switchboards, automatic transfer switches, panelboards, motor control centers, and standalone motor controllers, shall be tested prior to field loop testing.
    b. The Contractor shall perform Owner-witnessed field loop testing to demonstrate the capability of the control system to monitor the field devices and exert control over control elements, such as valve actuators.
    c. Field loop testing and Demonstration may be completed per unit process. Failure of one component of the overall process shall require retesting of the entire unit process.
3. The Contractor shall demonstrate that each piece of equipment operates in Hand or Manual control.
4. The Contractor shall demonstrate the ability of the automation system to operate each unit process.

3.02 FIELD LOOP TESTING

A. Schedule at least two (2) working days prior to when the Owner witnessing is desired or anticipated. Unless agreed to in writing, testing shall start at 9:30 am on the day scheduled. It shall be acceptable to schedule multiple units for field testing during the same day.

B. Failure in a unit shall be corrected by the Contractor.

1. The Contractor shall reschedule the failed unit and any additional units scheduled within two (2) working days for no less than two (2) full working days in the future.
2. The Owner shall retain the right to allow minor corrections and continue testing without deeming the test a failure. The Owner may allow corrections on some units without forfeiting the right to declare other units as failing without allowing minor corrections by the Contractor.
3. The Owner may not provide troubleshooting assistance.
4. The Contractor shall reimburse the Owner for the PLC Programmers, Engineers, Travel, and incidental cost of the second and each additional loop test required due to a failure of the field loop tests.

C. Owner witnessed testing will be for complete and working equipment. Incomplete wiring will be considered a failure of the entire unit.

1. The Contractor shall perform a rehearsal of the field loop tests to avoid delays caused by malfunctioning or incompletely connected equipment.

2. The Contractor shall notify the Owner, in writing, at least 2 working day prior to the Contractor's desired testing time. The Owner, if so desired by the Owner, may schedule an earlier time if acceptable to the Contractor.
3. If conductors to equipment require termination, then that piece of equipment has failed the Owner's witness test. In other words, equipment lacking wire labels, incorrect termination or has been partially completed will be marked as failed.
4. Unless noted otherwise, the entire control system for a shall be tested at once. A failure of any component may, at the Owner's option, require a retest of the entire system.
5. If test is deemed unsatisfactory, the Owner may stop all further testing. The Contractor shall correct all known problems, rehearse the test, and propose a new desired testing time not less than 10 working days prior to the time of the failed test. The Owner, if so desired by the Owner, may schedule an earlier time if acceptable to the Contractor.

D. ANALOG LOOP AND DISCRETE SIGNAL TESTING

1. Use the actual instruments to be installed.
2. Demonstrate the linearity of the analog input signals. It is acceptable to use a diagnostic mode to test the actual field instruments. For each analog signal to the PLC, provide the register value as well as the field sourced value for the following:
    a. The PLC register value at 0 mA field signal (open loop)
    b. The PLC register value at 3.2 mA field signal (under range)
    c. The PLC register value at 4.5 – 6.5 mA field signal (low range value)
    d. The PLC register value at 11.5 – 13.5 mA field signal (middle range value)
    e. The PLC register value at 17.5 – 19.5 mA field signal (high range value)
    f. The PLC register value at 20.6 mA field signal (over range)
3. Check the linearity of the analog output signals. For each analog output, including installed spare channels, provide the register value as well as the field measurements from the end device (using a diagnostic mode) for the following:
    a. The field value when the PLC register is configured to send 3.2 mA (under range).
    b. The field value when the PLC register is configured to send 5mA (low range value).
    c. The field value when the PLC register is configured to send 12 mA (middle range value).
    d. The field value when the PLC register is configured to send 19 mA (high range value).

e. The field value when the PLC register is configured to send 20.6 mA (over range).

f. For each analog loop, calculate the deviation using the following formula:

$$Deviation = 100\% \times \left|1 - \frac{Value_{19mA\ Observed} + Value_{5mA\ Observed}}{2 \times Value_{12mA\ Observed}}\right|$$

1) Report the deviation on the testing forms.

2) If the calculated Deviation exceeds 3%, the Contractor shall provide either one or both of the following solutions:

a) Perform at least a 7-point calibration and programmatically adjust the output signal to be within 1% of the expected value.

b) Replace the module containing the high deviation channel and retest the systems affected by the module.

4. Demonstrate each discrete output from the PLC to field device. Document proper operation of each output.

5. Demonstrate each discrete input.

a. Cause the mechanical switch to actuate by adjusting the setpoint or manually actuating the actual device. If none of the above methods are practical, it is acceptable to short the signaling circuit at the remote device to simulate the closure of a normally open contact or to simulate the opening of a normally closed contact by disconnecting the signaling circuit at the field device.

3.03 DEMONSTRATION

A. In general, the demonstration shall verify the electrical system's ability to fulfill the operational requirements of the electrical design.

1. Each individual component shall be disabled by disconnecting or powering off, individually to demonstrate the failure modes with a single device failure.

2. Each connection shall be verified.

B. CONTROL PANEL DEMONSTRATION

1. Control panels with several unit processes connected may be demonstrated per unit process or as a total control panel as submitted by the Demonstration Plan.

2. Demonstrate each I/O point through changing state of each field device.

3. Pump alarms shall be generated to initiate an alarm notification where practical. For example, a high-pressure switch shutdown may be simulated by adjusting the setpoint into the pumps normal operational range.

4. Contractor shall note several pieces of equipment may be necessary to demonstrate the operation of a unit process.

C. ELECTRICAL DISTRIBUTION SYSTEM DEMONSTRATION

1. Switchboard Operation and Adjustment
    a. Exercise circuit breakers
    b. Verify enclosure heater.
    c. Verify meter if equipped matches hand-held unit.
2. Manual Transfer Switch Operation
    a. Transfer load to temporary generator connected through exterior plug.
3. Automatic Transfer Switch
    a. Simulate power outage by interrupting normal power.
    b. Verify communications between generator, ATS
4. Motor Control Center and Motor Control Panel
    a. Test overload function by setting to lowest setting which allows load to operate.
    b. Demonstrate motors are able to start and operate on normal power and generator power.
    c. Demonstrate power factor correction capacitors operate.w
5. Engine Generator
    a. Disable normal power to ATS.
    b. Attach and start engine generator
    c. Power two pumps, bringing both online sequentially while full building loads are connected and operating.
    d. Demonstrate remote annunciator panel (where equipped) displays “Not In Auto” alarm and “Battery alarm”
6. Engine Pump
    a. Disable electrical pumps and verify engine drive pump starts and is able to pump.

3.04 STARTUP

A. The Contractor shall provide a minimum of 2 man-days on site time for startup of the control system prior to, during and following the Contractor’s installation and testing. On site time shall be coordinated with the Owner on site time during startup but may include additional time when the Owner is not present.

1. The Contractor shall supply programing services to monitor and, if required, modify the PLC program

3.05 CLEANING

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.

END OF SECTION

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SECTION 26 08 16
ELECTRICAL DEMONSTRATION - FORMS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes forms to supplement and document the demonstration of the Control System in Factory Acceptance Tests, Field Loop Tests and Process Tests

B. Final control elements, instruments, controls, motors, and other process equipment for the unit processes comprise the demonstration.

C. Control panels specified under this section include:

1. Control Panel MCP
2. ATS Connected to Normal Contactor (Pump Station 19 Building)

D. ELECTRICAL DISTRIBUTION SYSTEM

1. Switchboards
   a. Main Circuit Breaker
2. Automatic Transfer Switches
   a. ATS A
   b. ATS B
3. Manual Transfer Switch
   a. MTS A
   b. MTS B

E. NETWORK COMMUNICATIONS SYSTEMS

1. Copper Communications Cable (horizontal distributions)

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 26 08 13 – Electrical Demonstration.

1.03 CONTROL PANEL

For each site:

A. PLC Controller

IP Address:

Subnet mask:

Default gateway:

B. Operator Interface

IP Address:

Subnet mask:

Default gateway:

C. Fuses

Fuse label matches diagram and protected device
Factory Automation/Acceptance Test

D. Uninterruptable Power Supply (UPS)

Shows error when battery disconnected
No error or warnings
UPS Powers CPU when normal power removed

1.04 SWITCHBOARD

A. NETA Testing

B. Circuit Breaker Adjusted

Meter IP Address:

1.05 MOTOR CONTROL CENTER

A. NETA Testing

B. Circuit Breaker Adjusted

C. Kirk-key Interlock

D.

Both Circuit Breakers may be opened
Circuit breaker may close when key is inserted.
Key works in either circuit breaker.

1.06 MOTOR CONTROL CENTER, MOTOR STARTER

A. Overload Relay

IP Address:

Subnet mask:

Default gateway:

B. Motor Characteristics:

Nameplate Motor RPM
Nameplate Full Load Amperage
Nameplate Horsepower
Nameplate Voltage

C. Driven Equipment Characteristics:

Minimum Operating Current

D. NETA Testing

E. Circuit Breaker/Motor Circuit Protector Adjusted

END OF SECTION

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SECTION 26 21 16
SERVICE EQUIPMENT

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Work consists of a new power service with the characteristics shown on the one-line diagram.

1.02 SCHEDULING WORK WITH THE UTILITY COMPANY

A. The Contractor shall be responsible for all scheduling and coordination with the utility company. The Contractor shall coordinate and schedule power outages, power service for operation and construction, and power service as may be required by the facility prior to Certificate of Occupancy.

1. Utility Contact (Pump Station 19):
   Susan Williams
   Customer and System Projects - Project Manager
   Puget Sound Energy
   Susan.Williams@pse.com
   Reference number 105095780

2. Utility Contact (Pump Station 31):
   Ryan Fish
   Customer and System Projects - Project Manager
   Puget Sound Energy
   Ryan.Fish@pse.com

B. The Contractor shall make all necessary applications for service with the utility and shall notify the owner in writing of any obligations that the owner must fulfill for service to be started, installed, or modified.

1.03 CONTRACTOR/UTILITY INTERFACE RESPONSIBILITIES

A. The requirements shown on the Drawings for power service to the sites are general in nature and the Contractor shall meet all of the serving utilities requirement to deliver a complete electric service.

B. The contractor shall coordinate and provide all required work and equipment to provide service to the sites as required by the serving utility.

C. UTILITY CHARGES

1. All service charges from the Utility for the work shown will be paid for by the Owner and shall not be included in the Contractor’s bid price.

2. The Contractor must coordinate work with the power utility and other utilities as necessary for installation of new service and service entrance requirements.

3. Utility charges, including all costs associated with utility meter and/or transformer changes, shall be paid directly by the Owner. Contractor is to submit Utility invoices for such work, without markup, to the Owner.

   a. The Contractor may use existing power supplies if such use does not impact the existing pump station performance.

   b. The Contractor may acquire a temporary power service from the utility. The Contractor shall pay all charges related to a temporary power service from the utility.

1.04 QUALITY ASSURANCE

Comply with all serving utility company standards and requirements.

1.05 REFERENCES

A. Work involving service installation shall be done in accordance with the serving utility's standards and the National Electric Code.

B. Service equipment shall be listed and labeled by UL as "suitable for use as service equipment."

C. The Utility prepared power design is included in Appendix D "PSE Utility Power Design" for reference. Provide work described on design drawings as "By Owner" or "By Developer" unless noted otherwise below.

1.06 SUBMITTALS

A. Prior to submittal to the Engineer, the Contractor shall submit all equipment and construction details (such as size, mounting height, location of equipment, etc.) to the serving utility for verification of compliance to the utility's requirements. Provide certification from manufacturer of equipment that the equipment is and will be acceptable to the electrical utility.

B. Provide switchboard specifications, shop drawings, and any other required submittal information to Utility Metering Department prior to submittal to Owner. Provide letter from Utility or similar response from Utility indicating the proposed materials meet utility requirements. Submit catalog data showing material information and conformance with specifications on the following:

   1. Utility Power CT cabinet

   2. Meter Base.

C. Products furnished by the Utility for Contractor's use do not require submittals for approval.

   1. Provide list of materials furnished by Electrical Utility.

PART 2 : PRODUCTS

2.01 GENERAL

A. Examine utility requirements for requirements for electrical service.

1. Puget Sound Energy: pse.com/accountsandservices/Construction/Pages/Utility-Installation-Requirements.aspx

B. COORDINATE WITH UTILITY

Task	**Contractor Responsibility**	**Electrical Utility Responsibility**	**Owner Responsibility**
Primary circuit excavation, splice vault, pull hole, trenching and shoring	X		
Primary circuit, conduit, splice vault, pull hole, and conductor installation		X	
Transformer		X	
Transformer Vault		X	
Excavation for Utility Transformer Vault			
Transformer Pad		X	
Transformer Grounding System	X		
Secondary Circuit and pull-hole excavation, trenching, and shoring	X		
Provide Secondary Circuit, conduit, pull hole, and conductors	X		
Provide Entrance Switchboard	X		
Meter		X	
Current Transformer (for Meter)		X	
Metering conductors		X	
Metering conductor installation	X		
Utility section, cabinet, meter base, locks and seals		X	
Utility connection fees Permanent Service			X
Utility service power usage Permanent Service			X
Utility connection fees Temporary Service	X		
Utility service power usage Temporary Service	X		
Contact PSE for Meter Base, PSE inspections, Site Readiness Inspection, Metering Site Visit	X		

2.02 UTILITY INTERFACE EQUIPMENT

A. METER BASE

1. Contractor shall coordinate with Utility on type of metering required and shall provide all labor and material necessary to meet Utility requirements.

B. TRANSFORMER VAULT AND PAD

1. The electrical utility will provide the transformer, transformer vault, and transformer pad.
2. Provide grounding system in accordance with Section 26 05 26 – Grounding and Bonding for Electrical Systems.

C. CONDUIT

1. The Contractor utility may purchase conduits from the Electrical Utility for the Secondary Circuit. The Owner will pay the Electrical utility; submit the utility charges to Owner with no markup.

PART 3 : EXECUTION

3.01 GROUND ELECTRODE SYSTEM

A. The grounded conductor and ground bus shall be connected to the grounding electrode system, via the grounding electrode conductor as indicated on system one-line diagram.

B. The system shall be as indicated in Article 250-81 of the National Electrical Code.

3.02 UNDERGROUND SECONDARY SERVICE

Install in accordance with Division 16 and to Electrical Utilities requirements.

3.03 UTILITY REQUIREMENT VERIFICATION

A. The contractor shall coordinate and submit all equipment, materials, etc. related to the utility work to the serving utility to verify conformance to the Utility's requirements for service. The contractor shall also submit any plans for the installation of the primary and secondary service for approval by the Utility prior to excavation. Any discrepancy between the Utility requirements and the Contract documents shall be brought to the immediate attention of the Engineer.

B. Contractor shall obtain permit and obtain L&I inspection prior to connection of power.

END OF SECTION

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SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 : GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.03 ACTION SUBMITTALS

A. Submittal documents shall conform to the requirements of Section 1-06 – Control of Materials and Section 26 00 00 – Electrical General.

B. Submittals shall include the manufacturer's name, address, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference. Include other information necessary to establish contract compliance of each item proposed to furnish.

C. Each item shall be clearly marked and provided with adequate sales and technical information to clearly show conformance with all aspects of the specification. Packages not provided as described above or largely incomplete shall be returned to the Contractor, without comment.

D. PRODUCT DATA: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

1. For each enclosure, provide the following information:

a. Enclosure nominal voltage source power voltage.

b. Equipment full load amperage (FLA) at nominal voltage.

c. Equipment maximum overcurrent protective device (MOCP) rating. Unless noted otherwise, assume a thermal-magnetic circuit breaker with "D" type tripping characteristics.

d. Size and quantity of lugs for incoming and outgoing power conductors. Include the range of wire gage rating of the lugs and if the lugs are suitable for terminating finely stranded wire.

E. SHOP DRAWINGS: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

2. Indicate on submitted diagrams the terminals for remote devices as shown on the wiring diagrams in the contract drawings.
3. Wire and terminal numbers shall be included on the schematic diagrams.
4. Shop Drawings shall be provided on 11” x 17” sheets maximum size, and shall be scaled using standard engineering or architectural scales.
5. Scaled elevation drawings of the exterior and interior with all devices clearly labeled.

1.04 INFORMATIONAL SUBMITTALS

A. MANUFACTURER SEISMIC QUALIFICATION CERTIFICATION: Submit certification that transformers, accessories, and components will withstand seismic forces expected in the project location. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control test reports.

C. Field quality-control test reports.

1.05 CLOSEOUT SUBMITTALS

OPERATION AND MAINTENANCE DATA: For transformers to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: Obtain each transformer type through one source from a single manufacturer.

B. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.07 DELIVERY, STORAGE, AND HANDLING

TEMPORARY HEATING: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.08 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 : PRODUCTS

2.01 MANUFACTURERS

A. AVAILABLE MANUFACTURERS: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Acme Electric Corporation.
    b. Eaton Electrical Sector; Eaton Corporation; Cutler-Hammer Products.
    c. General Electric Company.
    d. Sola/Hevi-Duty.
    e. Square D Co./Groupe Schneider NA; Schneider Electric.
    f. Tierney Electrical Manufacturing Co.

2.02 GENERAL TRANSFORMER REQUIREMENTS

A. DESCRIPTION: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. CORES: Grain-oriented, non-aging silicon steel.

C. COILS: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: **Aluminum**.

2.03 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces.

C. CORES: One leg per phase.

D. ENCLOSURE: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. TRANSFORMER ENCLOSURE FINISH: Comply with NEMA 250.

1. Finish Color: Gray.

F. TAPS FOR TRANSFORMERS SMALLER THAN 3 kVA: One 5 percent tap above normal full capacity.

G. TAPS FOR TRANSFORMERS 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

H. TAPS FOR TRANSFORMERS 25 kVA AND LARGER: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

I. INSULATION CLASS: 220 deg C, UL-component-recognized insulation system with a maximum of 80 deg C rise above 40 deg C ambient temperature.

J. ENERGY EFFICIENCY FOR TRANSFORMERS RATED 15 kVA AND LARGER:

1. Comply with Federal Law 10 CFR Part 431 (DOE 2016), NEMA ST 20 (latest edition) and list and label as complying with 10 CFR 429.

K. ELECTROSTATIC SHIELDING: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.
3. Shield Effectiveness:
    a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
    b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
    c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.

L. WALL BRACKETS: Manufacturer's standard brackets.

M. LOW-SOUND-LEVEL REQUIREMENTS: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.04 IDENTIFICATION DEVICES

NAMEPLATES: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 26 05 00 – Miscellaneous Electrical, "Identification for Electrical Systems."

2.05 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. FACTORY SOUND-LEVEL TESTS: Conduct sound-level tests on equipment for this Project.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 26 00 00 – Electrical General, "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. TESTS AND INSPECTIONS

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. INFRARED SCANNING: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

E. TEST LABELING: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.04 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

Transformer Schedule <Still need to update>

	Primary Voltage	Secondary Voltage	Type	Size	Efficiency
T1	480	208/120Y	Delta - Wye	15 kVA	97.89%

END OF SECTION

SECTION 26 22 13
LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 : GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

B. The following table summarizes the transformers provided:

Transformer Schedule					
	Primary Voltage	**Secondary Voltage**	**Type**	**Size**	**Efficiency**
PS19 T-LA1	480	240/120	Single Phase	50 kVA	98.20%

1.03 ACTION SUBMITTALS

A. Submittal documents shall conform to the requirements of Section 1-06 – Control of Materials and Section 26 00 00 – Electrical General.

B. Submittals shall include the manufacturer's name, address, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference. Include other information necessary to establish contract compliance of each item proposed to furnish.

C. Each item shall be clearly marked and provided with adequate sales and technical information to clearly show conformance with all aspects of the specification. Packages not provided as described above or largely incomplete shall be returned to the Contractor, without comment.

D. PRODUCT DATA: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

1. For each enclosure, provide the following information:

a. Enclosure nominal voltage source power voltage.

b. Equipment full load amperage (FLA) at nominal voltage.

c. Equipment maximum overcurrent protective device (MOCP) rating. Unless noted otherwise, assume a thermal-magnetic circuit breaker with "D" type tripping characteristics.

d. Size and quantity of lugs for incoming and outgoing power conductors. Include the range of wire gage rating of the lugs and if the lugs are suitable for terminating finely stranded wire.

E. SHOP DRAWINGS: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Indicate on submitted diagrams the terminals for remote devices as shown on the wiring diagrams in the contract drawings.
3. Wire and terminal numbers shall be included on the schematic diagrams.
4. Shop Drawings shall be provided on 11” x 17” sheets maximum size, and shall be scaled using standard engineering or architectural scales.
5. Scaled elevation drawings of the exterior and interior with all devices clearly labeled.

1.04 INFORMATIONAL SUBMITTALS

A. MANUFACTURER SEISMIC QUALIFICATION CERTIFICATION: Submit certification that transformers, accessories, and components will withstand seismic forces expected in the project location. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control test reports.

C. Field quality-control test reports.

1.05 CLOSEOUT SUBMITTALS

OPERATION AND MAINTENANCE DATA: For transformers to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: Obtain each transformer type through one source from a single manufacturer.

B. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.07 DELIVERY, STORAGE, AND HANDLING

TEMPORARY HEATING: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.08 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 : PRODUCTS

2.01 MANUFACTURERS

A. AVAILABLE MANUFACTURERS: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Acme Electric Corporation.
    b. Eaton Electrical Sector; Eaton Corporation; Cutler-Hammer Products.
    c. General Electric Company.
    d. Sola/Hevi-Duty.
    e. Square D Co./Groupe Schneider NA; Schneider Electric.
    f. Tierney Electrical Manufacturing Co.

2.02 GENERAL TRANSFORMER REQUIREMENTS

A. DESCRIPTION: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. CORES: Grain-oriented, non-aging silicon steel.

C. COILS: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: **Aluminum**.

2.03 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces.

C. CORES: One leg per phase.

D. ENCLOSURE:

1. Ventilated, NEMA 250, Type 2.
2. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
3. Provide IR Viewing window positioned over the primary phase taps and lugs. Position window such that a thermal IR photo may be obtained without removal of the enclosure panels or doors.

E. TRANSFORMER ENCLOSURE FINISH: Comply with NEMA 250.

1. Finish Color: Gray.

F. VOLTAGE ADJUSTMENT TAPS

1. Transformers Smaller Than 3 kVA: Provide one 5 percent tap above normal full capacity.
2. Transformers 7.5 to 24 kVA: Provide one 5 percent tap above and one 5 percent tap below normal full capacity.
3. Transformers 25 kVA and Larger: Provide two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
4. Provide lugs in sizes and quantities as shown on drawings.

G. INSULATION CLASS: 220 deg C, UL-component-recognized insulation system with a maximum of 80 deg C rise above 40 deg C ambient temperature.

H. ENERGY EFFICIENCY FOR TRANSFORMERS RATED 15 KVA AND LARGER:

1. Comply with Federal Law 10 CFR Part 431 (DOE 2016), NEMA ST 20 (latest edition) and list and label as complying with 10 CFR 429.

I. ELECTROSTATIC SHIELDING: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.
3. Shield Effectiveness:
    a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
    b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.

c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.

J. WALL BRACKETS: Manufacturer's standard brackets.

K. LOW-SOUND-LEVEL REQUIREMENTS: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.04 IDENTIFICATION DEVICES

NAMEPLATES: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 26 05 00 – Miscellaneous Electrical, "Identification for Electrical Systems."

2.05 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. FACTORY SOUND-LEVEL TESTS: Conduct sound-level tests on equipment for this Project.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 26 00 00 – Electrical General, "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. TESTS AND INSPECTIONS

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. INFRARED SCANNING: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.

2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.

3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

E. TEST LABELING: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.04 CLEANING

Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 24 13
SWITCHBOARDS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

B. Provide the following switchboards in accordance with this section:

1. Outdoor Utility Switchboard (PS19)
    a. 600 Ampere, 480-volt, 3 phase, 4 wire, 60 Hertz frequency
    b. Short Circuit Current Rating of 65,000 amperes minimum
    c. NEMA 3R overall enclosure
    d. Three feeder circuit breakers, each 3 pole, 600 ampere frame circuit breakers
    e. Surge Protective Device

1.02 PERFORMANCE REQUIREMENTS

A. SEISMIC PERFORMANCE: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. See drawing S-1, “Structural General Notes”, for structural design data.

1.03 SUBMITTALS

A. Provide Main Circuit Breaker Panel submittal to electrical utility for approval simultaneously with submittal to Owner.

B. In accordance with the requirements of Section 1.05.11 – Project Data Submittals, submit the following:

1. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

2. Shop Drawings: For each switchboard and related equipment.

    a. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.

    b. Detail enclosure types for types other than NEMA 250, Type 1.

    c. Detail bus configuration, current, and voltage ratings.

    d. Detail short-circuit current rating of switchboards and overcurrent protective devices.

    e. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.

    f. Detail utility company's metering provisions with indication of approval by utility company.

    g. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

    h. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

    i. Include schematic and wiring diagrams for power, signal, and control wiring.

3. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems. Include the following:

    a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

    b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

    c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

4. Closeout Submittals:

   a. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified above, include the following:

      1) Routine maintenance requirements for switchboards and all installed components.

      2) Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

      3) Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

   b. Field Quality-Control Reports:

      1) Test procedures used.

      2) Test results that comply with requirements.

      3) Results of failed tests and corrective action taken to achieve test results that comply with requirements.

5. Maintenance Material Submittals:

   a. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

      1) Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

      2) Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

      3) Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

      4) Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

      5) Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.04 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. TESTING AGENCY QUALIFICATIONS: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. SOURCE LIMITATIONS: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. PRODUCT SELECTION FOR RESTRICTED SPACE: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.05 WARRANTY

A. SPECIAL WARRANTY: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.

C. Handle and prepare switchboards for installation according to NECA 400.

1.07 PROJECT CONDITIONS

A. ENVIRONMENTAL LIMITATIONS

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).

b. Altitude: Not exceeding 6600 feet (2000 m).

B. SERVICE CONDITIONS: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet (2000 m).

C. INTERRUPTION OF EXISTING ELECTRIC SERVICE: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.08 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

PART 2 : PRODUCTS

2.01 MANUFACTURED UNITS

A. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric.
2. Eaton Electrical Inc.; (formerly Cutler-Hammer).
3. Siemens Energy & Automation, Inc.

B. FRONT-CONNECTED, FRONT-ACCESSIBLE SWITCHBOARDS

1. Branch Devices: Individual mounted in separate sections with barriers between branch devices.
2. Sections front and rear aligned.

C. NOMINAL SYSTEM VOLTAGE: 480Y/277 V.

D. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 16041.

E. ENCLOSURES

1. Indoor Enclosures: Steel, NEMA 250, Type 1.
2. Outdoor Enclosures: Steel, NEMA 250, Type 3R.

F. BARRIERS: Between adjacent switchboard sections.

G. HINGED FRONT PANELS: Allow access to circuit breaker, accessory, and blank compartments.

H. BUSES AND CONNECTIONS: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with tin-plated aluminum or copper feeder circuit-breaker line connections.
2. Ground Bus: 1/4-by-2-inch hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
3. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
4. Neutral Buses: 50 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

I. FUTURE DEVICES: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.02 SURGE PROTECTION DEVICES

A. SURGE PROTECTION DEVICE (SPD) DESCRIPTION: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. SPD Type I and Type II unless noted otherwise.
3. Redundant suppression circuits.
4. Redundant replaceable modules.
5. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
6. LED indicator lights for power and protection status.

7. Audible alarm, with silencing switch, to indicate when protection has failed.

8. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

9. Four digit, transient-event counter set to totalize surge events.

B. PEAK SINGLE-IMPULSE SURGE CURRENT RATING: 160 kA per mode/320 kA per phase.

C. WITHSTAND CAPABILITIES: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

D. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277-V, three-phase, four-wire circuits shall be as follows:

1. Line to Neutral: 800 V for 480Y/277.

2. Line to Ground: 800 V for 480Y/277.

3. Neutral to Ground: 800 V for 480Y/277.

E. DISCONNECTING DEVICE: Provide molded case circuit breaker.

1. It is acceptable to provide a thermal-magnetic, molded case circuit breaker.

2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MOLDED-CASE CIRCUIT BREAKER (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

a. Instantaneous trip.

b. Long- and short-time pickup levels.

c. Long- and short-time time adjustments.

d. Ground-fault pickup level, time delay, and I2t response.

3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.

b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.

c. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

d. Alarm Contacts: One SPST switch with contacts which open when circuit-breaker opens on overcurrent.

2.04 ELECTRIC UTILITY SERVICE ENTRANCE RATED (EUSERC) METERING

A. Provide EUSERC 312 style metering section.

B. Provide materials as required and in accordance with Puget Sound Energy's Electrical Service Entrance requirements.

2.05 ACCESSORY COMPONENTS AND FEATURES

A. PORTABLE TEST SET: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

B. ENCLOSURE HEATER: Provide strip heater for moisture control.

1. Provide disconnect with overcurrent protection for heating circuit.
2. Provide thermostat to deactivate heater if ambient or enclosure increases above 55 degrees Fahrenheit.
3. Power to be supplied by 120 volts, 60 hertz, single phase, 2 wire plug ground, with an upstream overcurrent protective device will be 20 amperes

C. IR VIEWING WINDOW: Provide at least IR Viewing Window per branch circuit breaker. Position window over each branch circuit breaker load conductor terminations. Position on interior door if construction uses an exterior/interior door.

2.06 IDENTIFICATION

SERVICE EQUIPMENT LABEL: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NECA 400.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install switchboards and accessories according to NECA 400.

B. EQUIPMENT MOUNTING: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 03300 – Cast-in-Place Concrete.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.
5. Provide brush applied bitumastic water vapor barrier between housekeeping pad and the electrical equipment.

C. TEMPORARY LIFTING PROVISIONS: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Section 26 05 48.

E. OPERATING INSTRUCTIONS: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

H. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 26 05 53 – Identification for Electrical Systems.

B. SWITCHBOARD NAMEPLATES: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 26 05 53.

C. DEVICE NAMEPLATES: Label each disconnecting, and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 26 05 53.

D. Provide placard on switchboard exterior in accordance with WAC 296-46B-215.

3.04 FIELD QUALITY CONTROL

A. TESTING AGENCY: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. ACCEPTANCE TESTING PREPARATION

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. TESTS AND INSPECTIONS

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Switchboard will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified.

3.06 PROTECTION

TEMPORARY HEATING: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.07 DEMONSTRATION

Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION

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SECTION 26 24 16
PANELBOARDS

PART 1 : GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.

1.03 DEFINITIONS

A. SPD: Surge protective device

B. SVR: Suppressed voltage rating.

C. TVSS: Transient voltage surge suppressor.

1.04 ACTION SUBMITTALS

A. PRODUCT DATA: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. SHOP DRAWINGS: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.05 INFORMATIONAL SUBMITTALS

A. QUALIFICATION DATA: For qualified testing agency.

B. SEISMIC QUALIFICATION CERTIFICATES: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces expected in the project location. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. FIELD QUALITY-CONTROL REPORTS

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. PANELBOARD SCHEDULES: For installation in panelboards.

1.06 CLOSEOUT SUBMITTALS

A. OPERATION AND MAINTENANCE DATA: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI, Arc Fault Interrupting (AFI), Ground Fault Equipment Protection (GFEP), and combination Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

5. If required by connected load, provide rated duty HVAC or motor interrupting circuit breaker.

1.08 QUALITY ASSURANCE

A. TESTING AGENCY QUALIFICATIONS: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. SOURCE LIMITATIONS: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. PRODUCT SELECTION FOR RESTRICTED SPACE: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

A. ENVIRONMENTAL LIMITATIONS

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).

b. Altitude: Not exceeding 6600 feet (2000 m).

B. SERVICE CONDITIONS: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet (2000 m).

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. SPECIAL WARRANTY: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces expected for the project location.

B. ENCLOSURES: Surface mounted cabinets.

1. Rated for environmental conditions at installed location.
    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Outdoor Locations: NEMA 250, Type 3R.
    c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
4. Finishes:
    a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Same finish as panels and trim.
5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. INCOMING MAINS LOCATION: Top or bottom.

D. PHASE, NEUTRAL, AND GROUND BUSES

1. Material: Tin-plated aluminum.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Split Bus: Vertical buses divided into individual vertical sections.

E. CONDUCTOR CONNECTORS: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

F. SERVICE EQUIPMENT LABEL: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. FUTURE DEVICES: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. PANELBOARD SHORT-CIRCUIT CURRENT RATING: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 PERFORMANCE REQUIREMENTS

A. SEISMIC PERFORMANCE: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. SURGE SUPPRESSION: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1 and Type 2.

2.03 DISTRIBUTION PANELBOARDS

A. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Eaton Electrical; PowerLine or comparable product by one of the following:
   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

c. Square D; a brand of Schneider Electric.

B. PANELBOARDS: NEMA PB 1, power and feeder distribution type.

C. DOORS: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. MAINS: Circuit breaker or Lugs **only** as required.

E. BRANCH OVERCURRENT PROTECTIVE DEVICES FOR CIRCUIT-BREAKER: Bolt-on circuit breakers.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Eaton Electrical; PowerLine series or comparable product by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

c. Square D; a brand of Schneider Electric.

B. PANELBOARDS: NEMA PB 1, lighting and appliance branch-circuit type.

C. MAINS: Circuit breaker or lugs only as required.

D. BRANCH OVERCURRENT PROTECTIVE DEVICES: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. DOORS: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.05 LOAD CENTERS

A. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Eaton Electrical; PowerLine or comparable product by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

c. Square D; a brand of Schneider Electric.

B. LOAD CENTERS: Comply with UL 67.

C. MAINS: Circuit breaker.

D. BRANCH OVERCURRENT PROTECTIVE DEVICES: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. CONDUCTOR CONNECTORS: Mechanical type for main, neutral, and ground lugs and buses.

2.06 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Eaton Electrical or comparable product by one of the following:
    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    c. Square D; a brand of Schneider Electric.

B. MOLDED-CASE CIRCUIT BREAKER (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    a. Instantaneous trip.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

e. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

f. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.

h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. FUSED SWITCH: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.

2. Fuses shall be of the type and amperage indicated on the Drawings. The voltage rating shall be appropriate for the application indicated. The fuse types indicated on the Drawings imply a certain set of fuse characteristics. No substitutions of fuse types will be allowed without written approval from the Engineer.

3. All fuses used on the project shall be provided with “blown fuse” indicators.

4. Where fuses in motor circuits are indicated but not sized, provide Manufacturer's recommended fuse size based on actual motor installed.

5. Provide in-line or integrally-mounted fuse clips on control power or low-voltage transformer.

6. Provide fuse puller or pullers for fuse sizes used.

7. Provide surface mounted cabinet, sized to store required spare fuses at location coordinated with Owners Representative.

8. Provide a minimum of two spare fuses for each fuse used.

9. Acceptable Manufacturers:

a. Bussman.

b. Gould Shawmut.

c. Littlefuse.

d. Reliance.

2.07 ACCESSORY COMPONENTS AND FEATURES

ACCESSORY SET: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

2.08 SURGE SUPPRESSION

A. Where surge suppressor (SPD or TVSS) is specified or shown on the Drawings, provide integral surge suppression device with the following minimum characteristics:

1. Surge Current per phase – 120,000kA
2. Surge Current L – N 60,000kA
3. IEEE C3 Wave (10kA) – 9,000

B. Provide Surge arrestors, with indicators, where shown on the one-line diagrams to protect against overvoltage transients. JOSLYN J9200 series with protective capacitor GE model 9L18 or accepted equal. Select proper components for the application as shown on the Drawings.

C. Unit shall have overcurrent protection, infrared and thermal detection - Include diagnostic package and direct bus bar connection and 10 year warranty – Cutler Hammer Clipper CPS-S or accepted equal.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. EQUIPMENT MOUNTING: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.

5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. TEMPORARY LIFTING PROVISIONS: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements for manufacturer for seismic risk expected at project location.

E. Mount top of trim 78 inches above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 00 – Miscellaneous Electrical, "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. PANELBOARD NAMEPLATES: Label each panelboard with a nameplate complying with requirements for identification specified Section 26 05 00 – Miscellaneous Electrical, "Identification for Electrical Systems." Provide engraved (color layer - engraved through outer layer) plastic name plate with 1/2 inch high characters for panel identification (for panel name); attached with 316 stainless steel screws to each panelboard front. Emergency system - white on red; Normal system - black letters on white. Include voltage, phase and wire (i.e., 208Y/120V, 3 phase, 4 wire) in 3/8 inch characters.

D. DEVICE NAMEPLATES: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 00 – Miscellaneous Electrical, "Identification for Electrical Systems." Provide neatly type written as-built information for each panelboard by circuit with its proper load designation. Mount the panelboard circuit directory inside the door of each panelboard in a clear plastic sleeve. Provide one spare blank card for each card used.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. ACCEPTANCE TESTING PREPARATION

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. TESTS AND INSPECTIONS

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:
        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73.16 – Overcurrent Protective Device Coordination Study.

3.06 PROTECTION

Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

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SECTION 26 24 19
MOTOR-CONTROL CENTERS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes MCCs for use with ac circuits rated 600 V and less and having the following factory-installed components:

1. Incoming main lugs.
2. Feeder overcurrent protective devices.
3. Full-voltage magnetic controllers.
4. Instrumentation.
5. Auxiliary devices.

B. Provide the following Motor Control Centers

Site	Tag	Sections	Minimum Horizontal Bus Rating [Amperes]	SSCR [kilo Amperes]
PS19	MCC A	2	600	65
PS19	MCC B	2	600	65

1.02 RELATED SECTIONS

A. Provide magnetic contactors which meet the requirements of 26 29 13.11 – Across-the-Line Contactors.

B. Provide variable frequency drives which meet the requirements of 26 29 23 – Variable-Frequency Motor Controllers.

1.03 DEFINITIONS

A. BAS: Building automation system.

B. CE: Conformite Europeene (European Compliance).

C. CPT: Control power transformer.

D. EMI: Electromagnetic interference.

E. FVNR: Full voltage, non-reversing (magnetic motor starter)

F. FVR: Full voltage, reversing (magnetic motor starter)

G. GFCI: Ground fault circuit interrupting.

H. IGBT: Insulated-gate bipolar transistor.

I. kA: kilo-Amperes (1,000 Amperes)

J. LAN: Local area network.

K. LED: Light-emitting diode.

L. MCC: Motor-control center.

M. MCCB: Molded-case circuit breaker.

N. MCP: Motor-circuit protector.

O. NC: Normally closed.

P. NO: Normally open.

Q. OCPD: Overcurrent protective device.

R. PCC: Point of common coupling.

S. PID: Control action, proportional plus integral plus derivative.

T. PT: Potential transformer.

U. PWM: Pulse-width modulated.

V. RFI: Radio-frequency interference.

W. SCR: Silicon-controlled rectifier.

X. TDD: Total demand (harmonic current) distortion.

Y. THD(V): Total harmonic voltage demand.

Z. TVSS: Transient voltage surge suppressor.

AA. VFC: Variable-frequency controller.

BB. VFD: Variable-frequency drive.

1.04 PERFORMANCE REQUIREMENTS

A. Seismic Performance: MCCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.05 SUBMITTALS

A. PRODUCT DATA

1. For each type of controller and each type of MCC.
2. Include shipping and operating weights, features, performance, electrical ratings, operating characteristics, and furnished specialties and accessories.

B. SHOP DRAWINGS

1. For each MCC, manufacturer's approval and production drawings as defined in UL 845.
2. In addition to requirements specified in UL 845, include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
3. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    a. Each installed unit's type and details.
    b. Factory-installed devices.
    c. Enclosure types and details.
    d. Nameplate legends.
    e. Short-circuit current (withstand) rating of complete MCC, and for bus structure and each unit.
    f. Features, characteristics, ratings, and factory settings of each installed controller and feeder device, and installed devices.
    g. Specified optional features and accessories.
4. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring for each installed controller.
5. Nameplate legends.
6. Vertical and horizontal bus capacities.
7. Features, characteristics, ratings, and factory settings of each installed unit.
8. Standard Drawings: For each MCC, as defined in UL 845.
9. Seismic Qualification Certificates: For MCCs, accessories, and components, from manufacturer.
    a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
    c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

d. Qualification Data: For qualified testing agency.

10. Product Certificates: For each MCC, from manufacturer.

11. Source quality-control reports.

12. Field quality-control reports.

13. Load-Current and Overload-Relay Setting List: Compile after motors have been approved and arrange to demonstrate that selection of overload relays suits actual motor nameplate full-load currents.

14. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

C. WARRANTY: Sample of special warranty.

D. OPERATION AND MAINTENANCE DATA: For MCCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 1-11 – Operation and Maintenance Data, include the following:

1. Manufacturer's Record Drawings: As defined in UL 845. In addition to requirements specified in UL 845, include field modifications and field-assigned wiring identification incorporated during construction by manufacturer, Contractor, or both.

2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.

3. Manufacturer's written instructions for setting field-adjustable overload relays.

4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage, solid-state controllers.

5. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.

6. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

E. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

3. Indicating Lights: Two of each type and color installed.

4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.

5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.06 QUALITY ASSURANCE

A. TESTING AGENCY QUALIFICATIONS: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. SOURCE LIMITATIONS: Obtain MCCs and controllers of a single type from single source from single manufacturer.

C. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver MCCs in shipping splits of lengths that can be moved past obstructions in delivery paths.

B. Handle MCCs according to the following:

1. NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers Rated Not More Than 600 Volts."
2. NECA 402, "Recommended Practice for Installing and Maintaining Motor Control Centers."

C. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside MCCs; install temporary electric heating, with at least 250 W per vertical section.

1.08 PROJECT CONDITIONS

A. ENVIRONMENTAL LIMITATIONS: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
2. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
3. Humidity: Less than 95 percent (noncondensing).
4. Altitude: Exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.

B. PRODUCT SELECTION FOR RESTRICTED SPACE: Drawings indicate maximum dimensions for MCCs, including clearances between MCCs and adjacent surfaces and other items.

1.09 COORDINATION

A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate features of MCCs, installed units, and accessory devices with remote pilot devices and control circuits to which they connect.

C. Coordinate features, accessories, and functions of each MCC, each controller, and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.

PART 2 : PRODUCTS

2.01 MANUFACTURED UNITS

A. BASIS-OF-DESIGN PRODUCT: Subject to compliance with requirements, provide product by one of the following:

1. Rockwell Automation, Inc.; Allen-Bradley Brand.
2. Eaton Electrical; (formerly) Cutler-Hammer
3. Schneider Electric; Square D

B. GENERAL REQUIREMENTS FOR MCCS: Comply with NEMA ICS 18 and UL 845.

C. Motor controllers, such as VFD and motor starters, must be manufactured by the same company as the MCC.

2.02 FUNCTIONAL FEATURES

A. DESCRIPTION: Modular arrangement of main units, controller units, control devices, feeder-tap units, instruments, metering, auxiliary devices, and other items mounted in vertical sections of MCC.

B. CONTROLLER UNITS: Combination controller units.

1. Install units up to and including magnetic motor starter Size 3 on draw-out mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
2. Provide units in with pull-apart terminal strips for external control connections for control and signal wiring.
    a. Motor branch circuits my connect directly to the motor controller or relay device.

C. FEEDER-TAP UNITS

1. Units 225-A rating and smaller shall have draw-out mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
2. Larger than 225-A rating may be fixed mounted in separate unit.

D. TIE BREAKER DISCONNECTING DEVICE

1. Provide mechanical interlock system for tie circuit breakers such that a bus may not be energized by two sources simultaneously.
2. Mechanical interlock must not prevent protective features of the disconnecting device, it any.
3. Tie Breaker may be an enclosed switches or molded-case circuit breaker.

E. FUTURE UNITS: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of motor controller units.

F. SPARE UNITS: Installed in compartments indicated "spare."

2.03 INCOMING MAINS

A. INCOMING MAINS LOCATION: Bottom.

B. MAIN LUGS ONLY: Conductor connectors suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Main and Neutral Lugs: Compression type.

2.04 MOTOR CONTROLLERS

A. Meet the requirements of Section 26 29 13.11 – Across-the-Line Contactors.

B. Meet the requirements of Section 26 35 26 – Harmonic Filters.

C. Meet the requirements of Section 26 29 23 – Variable Frequency Motor Controllers.

2.05 INSTRUMENTATION

Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.

2.06 MULTIFUNCTION DIGITAL-METERING MONITOR:

A. Microprocessor-based unit suitable for three-wire systems and with the following features:

B. Listed or recognized by a nationally recognized testing laboratory.

C. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.

D. Switch-selectable digital display of the following values with the indicated maximum accuracy tolerances:

1. Phase Currents, Each Phase: Plus or minus 1 percent.
2. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
3. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
4. Three-Phase Real Power (Megawatts): Plus or minus 2 percent.
5. Three-Phase Reactive Power (Megavars): Plus or minus 2 percent.
6. Power Factor: Plus or minus 2 percent.
7. Frequency: Plus or minus 0.5 percent.
8. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
9. Harmonic Distortion: Voltage and current up to the 99th Harmonic
10. Logging for up to 13 months of recorded usage.
    a. Logging must be continuous with averaging demand for increments up to 10-minute demand windows.
    b. Logging data must be retrievable through the ethernet interface by the integral webpage or FTP.

E. MOUNTING: Display and control unit flush or semiflush mounted in compartment door.

F. Integral demand indicator.

G. Removable meter with drawout test plug.

H. Semiflush mounted case with matching cover.

I. ETHERNET NETWORK CONNECTION

1. Provide built-in, embedded web server capable of displaying measured and accumulated values described above.
2. Provide built-in, embedded gateway capable of transmitting measured, status and diagnostic information through Rockwell Automation Ethernet/IP or Modbus TCP.
3. Connection must be compatible with Cat-5e or Cat-6 cabling.
4. The network connection shall be compatible with Owners network equipment and shall use 10/100TX over copper communications cable, Cat-5e or better, using RJ45 style ports and plugs.

2.07 MCC CONTROL POWER

A. CONTROL CIRCUITS: 120-V ac, supplied through secondary disconnecting devices from CPT.

1. Stagger the phases which the CPT is connected such that the entire MCC load are reasonably balanced

B. CONTROL POWER FUSES: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. CONTROL WIRING: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

D. POWER SUPPLIES: 24-V dc; supplied after overcurrent disconnecting device.

2.08 ENCLOSURES

A. INDOOR ENCLOSURES: Freestanding steel cabinets unless otherwise indicated. NEMA 250, Type 1A unless otherwise indicated to comply with environmental conditions at installed location.

B. ENCLOSURE FINISH FOR INDOOR UNITS: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

C. COMPARTMENTS: Modular; individual doors with concealed hinges and quick-captive screw fasteners. Interlocks on units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.

D. INTERCHANGEABILITY: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in MCC; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.

E. WIRING SPACES

1. Vertical wireways in each vertical section for vertical wiring to each unit compartment; supports to hold wiring in place.
2. Horizontal wireways in bottom and top of each vertical section for horizontal wiring between vertical sections; supports to hold wiring in place.

2.09 LAYOUT

A. The MCCs must house at least the following equipment:

1. Motor Control Center MCC A

Main Lugs		
Meter	MCC Feeder Conductors	3 wire, 3 phase
Power Supply 24VDC		
Transformer T-LA (Kirk Key Interlock w/ MCC B)		
Feeder Circuit Breaker		
RVSS Motor Starter	Raw Sewage Pump 1	
Contactor	Raw Sewage Pump 1 Power Correction Capacitor	

2. Motor Control Center MCC B

Main Lugs		
Meter	MCC Feeder Conductors	3 wire, 3 phase
Power Supply 24VDC		
Transformer T-LA (Kirk Key Interlock w/ MCC A)		
Feeder Circuit Breaker		
RVSS Motor Starter	Raw Sewage Pump 2	
Contactor	Raw Sewage Pump 2 Power Correction Capacitor	

2.10 AUXILIARY DEVICES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.
    a. Push Buttons: Recessed types; momentary contact unless otherwise indicated.
    b. Pilot Lights: LED types; push to test.
    c. Selector Switches: Rotary type.
2. Elapsed-Time Meters: Heavy duty with digital readout in hours; non-resettable.

B. Reversible NC/NO contactor auxiliary contact(s).

C. CONTROL RELAYS: Auxiliary and adjustable solid-state time-delay relays.

D. PHASE-FAILURE, PHASE-REVERSAL, AND UNDERVOLTAGE AND OVERVOLTAGE RELAYS: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

E. Cover gaskets for Type 1 enclosures.

F. THREE PHASE 480VAC TO 24VDC POWER SUPPLY:

1. 3-phase 480 Volts Alternating Current input with 24 Volts direct current output with a user adjustable voltage trim.
2. Provide through-door disconnect switch operator to remove 480 volt power to power supply.
3. Provide 20 amperes at 24 Volts direct current unless noted otherwise.
4. Provide Sola Hevi-Duty SDN-C series, or equal.

G.

2.11 CHARACTERISTICS AND RATINGS

A. WIRING: NEMA ICS 18, Class I, Type B.

B. CONTROL AND LOAD WIRING: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

C. NOMINAL SYSTEM VOLTAGE: 480 V, three phase, three wire.

D. SHORT-CIRCUIT CURRENT RATING FOR EACH Unit: Fully rated; 65 kA.

E. SHORT-CIRCUIT CURRENT RATING OF MCC: Fully rated with its main overcurrent device; 65 kA.

F. ENVIRONMENTAL RATINGS

1. Ambient Temperature Rating: Not less than 0 deg F (minus 18 deg C) and not exceeding 104 deg F (40 deg C), with an average value not exceeding 95 deg F (35 deg C) over a 24-hour period.
2. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
3. Humidity Rating: Less than 95 percent (noncondensing).
4. Altitude Rating: Not exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.

G. MAIN-BUS CONTINUOUS RATING: 600 A.

H. VERTICAL-BUS MINIMUM CONTINUOUS RATING: 300 A.

I. HORIZONTAL AND VERTICAL BUS BRACING (SHORT-CIRCUIT CURRENT RATING): Match MCC short-circuit current rating.

J. MAIN HORIZONTAL AND EQUIPMENT GROUND BUSES: Uniform capacity for entire length of MCC's main and vertical sections. Provide for future extensions from both ends.

K. VERTICAL PHASE AND EQUIPMENT GROUND BUSES: Uniform capacity for entire usable height of vertical sections, except for sections incorporating single units.

L. PHASE-BUS MATERIAL: Hard-drawn copper of 98 percent conductivity, silver plated.

M. GROUND BUS: Minimum size required by UL 845, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit equipment grounding conductors.

N. FRONT-CONNECTED, FRONT-ACCESSIBLE MCCs:

1. Main Devices: Drawout mounted.
2. Controller Units: Drawout mounted.
3. Feeder-Tap Units: Drawout mounted.
4. Sections front and rear aligned.

O. BUS TRANSITION AND INCOMING PULL SECTIONS: Matched and aligned with basic MCC.

P. BUS-BAR INSULATION: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

2.12 SOURCE QUALITY CONTROL

A. MCC TESTING: Inspect and test MCCs according to requirements in NEMA ICS 18.

B. MCCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine areas and surfaces to receive MCCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate layout and installation of MCCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. FLOOR-MOUNTING CONTROLLERS: Install MCCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Section 03 30 00 – Cast-in-Place Concrete.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. TEMPORARY LIFTING PROVISIONS: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in control circuits if not factory installed.

E. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 – Identification for Electrical Systems for identification of MCC, MCC components, and control wiring.

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label MCC and each cubicle with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

4. Mark up a set of manufacturer's connection wiring diagrams with field-assigned wiring identifications and return to manufacturer for inclusion in Record Drawings.

B. OPERATING INSTRUCTIONS: Frame printed operating instructions for MCCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of MCCs.

3.04 CONTROL WIRING INSTALLATION

A. Bundle, train, and support wiring in enclosures.

B. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.

2. Connect selector switches within enclosed controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.05 CONNECTIONS

A. Comply with requirements for installation of conduit in Section 26 05 33– Raceways and Boxes for Electrical Systems. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Comply with requirements in Section 26 05 26– Grounding and Bonding for Electrical Systems.

3.06 FIELD QUALITY CONTROL

A. TESTING AGENCY: Engage a qualified testing agency to perform tests and inspections.

B. MANUFACTURER'S FIELD SERVICE: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. ACCEPTANCE TESTING PREPARATION

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

D. TESTS AND INSPECTIONS

1. Inspect controllers, wiring, components, connections, and equipment installation.
2. Test insulation resistance for each enclosed controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Engineer before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
9. Mark up a set of manufacturer's drawings with all field modifications incorporated during construction and return to manufacturer for inclusion in Record Drawings.

E. Enclosed controllers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.07 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.08 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.

C. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage, solid-state controllers.

D. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73.16 – Overcurrent Protective Device Coordination Study.

3.09 PROTECTION

A. TEMPORARY HEATING: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage, solid-state controllers.

END OF SECTION

SECTION 26 27 13
UTILITY POWER SERVICE & METERING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Work consists of a new power service with the characteristics shown on the one-line diagram.

B. Pump Station 19, connect new CT metering cabinet to existing electrical power from utility transformers. Provide new pathway including in-ground utility handhole vault.

C. Pump Station 31, connect new meter to existing electrical power from utility transformers. Provide new pathway.

1.02 SCHEDULING WORK WITH THE UTILITY COMPANY

A. The Contractor shall be responsible for all scheduling and coordination with the utility company. The Contractor shall coordinate and schedule power outages, power service for operation and construction, and power service as may be required by the facility prior to Certificate of Occupancy.

1. Utility Contact:
   Al Warren
   Customer and System Projects - Project Manager
   Puget Sound Energy
   Alfred.warren @pse.com

B. The Contractor shall make all necessary applications for service with the utility and shall notify the owner in writing of any obligations that the owner must fulfill for service to be started, installed, or modified.

1.03 CONTRACTOR/UTILITY INTERFACE RESPONSIBILITIES

A. The requirements shown on the Drawings for power service to the sites are general in nature and the Contractor shall meet all of the serving utilities requirement to deliver a complete electric service.

B. The contractor shall coordinate and provide all required work and equipment to provide service to the sites as required by the serving utility.

C. The Contractor must provide all work shown on the Utility – Owner agreement which is described by the Utility as provided by Owner or provided by other than the Utility.

D. UTILITY CHARGES

1. All service charges from the Utility for the work shown will be paid for by the Owner and shall not be included in the Contractor’s bid price.

2. The Contractor must coordinate work with the power utility and other utilities as necessary for installation of new service and service entrance requirements.

3. Utility charges, including all costs associated with utility meter and/or transformer changes, shall be paid directly by the Owner. Contractor is to submit Utility invoices for such work, without markup, to the Owner.

    a. The Contractor may use existing power supplies if such use does not impact the existing pump station performance.

    b. The Contractor may acquire a temporary power service from the utility. The Contractor shall pay all charges related to a temporary power service from the utility.

1.04 QUALITY ASSURANCE

Comply with all serving utility company standards and requirements.

1.05 REFERENCES

A. Work involving service installation shall be done in accordance with the serving utility's standards and the National Electric Code.

B. Service equipment shall be listed and labeled by UL as "suitable for use as service equipment."

1.06 SUBMITTALS

A. Prior to submittal to the Engineer, the Contractor shall submit all equipment and construction details (such as size, mounting height, location of equipment, etc.) to the serving utility for verification of compliance to the utility's requirements. Provide certification from manufacturer of equipment that the equipment is and will be acceptable to the electrical utility.

B. Provide switchboard specifications, shop drawings, and any other required submittal information to Utility prior to submittal to Owner, submit catalog data showing material information and conformance with specifications on the following:

    1. Utility Power CT cabinet

    2. Meter Base.

C. Products furnished by the Utility for Contractor's use do not require submittals for approval.

    1. Provide list of materials furnished by Electrical Utility.

PART 2 : PRODUCTS

2.01 GENERAL

A. Examine utility requirements for requirements for electrical service.

1. Puget Sound Energy: pse.com/accountsandservices/Construction/Pages/Utility-Installation-Requirements.aspx

B. Coordinate with Utility

Task	Contractor Responsibility	Electrical Utility Responsibility	Owner Responsibility
Excavation, trenching and shoring	X		
Primary circuit, conduit and conductor installation		X	
Transformer		X	
Transformer Vault		X	
Transformer Pad		X	
Transformer Grounding System	X (N.I.C.)		
Provide Secondary Circuit, conduit and conductors	X		
Provide Utility Handhole Vault – Furnish and Set		X	
Furnish Secondary Conduit	X		
Provide Entrance Switchboard, Metering Cabinet, Meter Base, Utility Disconnect	X		
Termination of Secondary Conductors at Meter and Utility Transformers		X	
Utility Power Meter		X	
Current Transformer (for Meter)		X	
Metering conductors		X	
Metering conductor installation	X		
Utility section locks and seals		X	
Utility connection fees Permanent Service			X
Utility service power usage Permanent Service			X
Utility connection fees Temporary Service	X		
Utility service power usage Temporary Service	X		

2.02 UTILITY INTERFACE EQUIPMENT

A. METER BASE

1. Contractor shall coordinate with Utility on type of metering required and shall provide all labor and material necessary to meet Utility requirements.

B. TRANSFORMER VAULT AND PAD

1. The electrical utility will provide the transformer, transformer vault, and transformer pad.
2. Provide grounding system in accordance with Section 26 05 26 – Grounding and Bonding for Electrical Systems.

C. CONDUIT

1. The Contractor utility may purchase conduits from the Electrical Utility for the Secondary Circuit. The Owner will pay the Electrical utility; submit the utility charges to Owner with no markup.

D. UTILITY HANDHOLE VAULT

1. The Contractor utility may purchase vaults from the Electrical Utility for the Secondary Circuit. The Owner will pay the Electrical utility; submit the utility charges to Owner with no markup.

PART 3 : EXECUTION

3.01 GROUND ELECTRODE SYSTEM

A. The grounded conductor and ground bus shall be connected to the grounding electrode system, via the grounding electrode conductor as indicated on system one-line diagram.

B. The system shall be as indicated in Article 250-81 of the National Electrical Code.

3.02 UNDERGROUND SECONDARY SERVICE

Install in accordance with Division 26 and to Electrical Utilities requirements.

3.03 UTILITY REQUIREMENT VERIFICATION

A. The contractor shall coordinate and submit all equipment, materials, etc. related to the utility work to the serving utility to verify conformance to the Utility's requirements for service. The contractor shall also submit any plans for the installation of the primary and secondary service for approval by the Utility prior to excavation. Any discrepancy between the Utility requirements and the Contract documents shall be brought to the immediate attention of the Engineer.

B. Contractor shall obtain permit and obtain L&I inspection prior to connection of power.

END OF SECTION

ATTACHMENT: PUGET SOUND ENERGY (PSE) COMMERCIAL ELECTRIC FACILITIES CONTRACT

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SECTION 26 27 26
WIRING DEVICES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section covers furnishing and installing miscellaneous electrical wiring devices indicated on the Drawings.

B. This sections includes the following:

1. Switches and Receptacles
2. Cover plates
3. Engine generator inlet receptacles

1.02 REFERENCES

A. 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.

B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.

C. All materials and equipment specified herein, and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C.

1.03 COORDINATION

The Contractor is responsible for coordination of mechanical equipment, fans, louvers, heaters, motors, starters, etc. and the electrical power and control requirements. Provided in this section and other Sections of the specifications and Drawings.

1.04 SUBMITTALS

A. In accordance with the requirements in Section 1-06 and Section 26 00 00 – Electrical General, submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

B. A copy of this section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (√) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the

paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification Sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

C. Provide all electrical information – wire diagrams, terminal information and numbering and electrical / power data.

D. Include the material proposed for each piece of equipment.

PART 2 : PRODUCTS

2.01 GENERAL

All wiring shall be installed in raceways unless specifically noted otherwise.

2.02 SWITCHES AND RECEPTACLES

A. Standard wall switches shall be single-pole, or double-pole, three-way, as shown on the Drawings or as required for the application. Switches shall be AC Industrial or heavy-duty type rated 20 amp, 125/277 volt with screw terminals. Wiring devices shall be ivory colored for general use office areas, and black when installed in mechanical rooms or when mounted on dark walls. Receptacles on emergency or backup power shall be labeled or color coded.

1. Shall be manufactured by Leviton, ARROW HART, BRYANT, HUBBELL, P&S or equal.
2. Provide manual motor starting rated snap switch where motor rated snap switch is indicated.
3. Provide pilot light (illuminated when enabled) snap switches for exterior light controls or where indicated.
4. Provide occupancy sensing light switches for interior illumination lighting receptacles.

B. Weather proof switches for use in damp, corrosive or outdoor applications shall be:

1. Die cast aluminum housing with lever type switch CROUSE-HINDS, DS185, or;
2. Non metallic, UL marine listed, CARLON, E98TSC or equal.

C. Weather proof receptacles for use in damp or corrosive applications shall be:

1. Die cast aluminum with spring and gasketed covers CROUSE-HINDS, WL series, or;
2. Non metallic, CARLON or equal.

D. Weather proof receptacles covers for outdoor applications shall be:

1. Intermatic Extra-Duty Die-Cast, In-Use WP Series with lockable hasp hole or equal.

E. Provide GFI receptacles where required by the NEC and where indicated.

F. Provide GFCI receptacles where required by the NEC and where indicated.

G. Per the nameplate requirements, provide circuit and panel data labels on all switches and receptacles and label all light switches with function.

H. COVER PLATES

1. Scope: Provide plate for each wiring device, for each signal or communication outlet.
2. Device plates on flush devices, in general, shall be satin finish 316 stainless steel Sierra 302 316 stainless steel line or accepted equal, modern classic design, corrosion resistant. Special finish plates shall be provided to match special paneled walls as directed by Owner.
3. Device plates for switches in outdoor areas shall have weatherproof plates with hinged cover and 316 stainless steel screws. Sierra Electric WP series or accepted equal.
4. Plates on exposed wiring shall be of metal, of the same manufacture as the conduit fittings; specifically suited for device and fitting used.
5. Blank, Bushed or Special Outlet Plates: Provide for all signal communication system outlets as required.

I. SPECIAL ACCESSORIES

1. Provide accessories such as junction boxes, outlet boxes, etc. necessary to mount switches and receptacles in a proper and approved method.

J. ENGINE GENERATOR INLET RECEPTACLE

1. Shall be compatible with Owner’s portable engine generator. Shall be rated for 400 Amperes of capacity connection.
2. Provide Appleton (Emerson) PowerTite Pin and Sleeve Plugs and receptacles:
   a. Receptacles must have 4 pole, rated for 400 amperes at 480/277VAC, 4 wire, 3 phase with dedicated grounding connection.
   b. Provide power distribution block suitable for 4 wire, 3 phase for terminating two sets each of #3/0 gage phase conductors.
3. Provide compatible back box with housing.

PART 3 : EXECUTION

3.01 GENERAL

A. Provide services of an authorized representative of manufacturer to visit site of work and inspect, check, adjust if necessary, and approve equipment installation.

B. Assure that equipment manufacturer's representative is present when equipment is placed in operation.

C. Verify that equipment representative revisits job site as often as necessary until all trouble is corrected and equipment installation and operation are satisfactory, in opinion of Engineer.

D. Verify that motor overcurrent protection is in accordance with the N.E.C.

E. Verify the motor protection and control is in accordance with the equipment manufacturers requirements.

3.02 OUTLETS AND SWITCHES

A. For all receptacles, switches, and other related devices of the lighting and receptacle system, provide all necessary raceway and wire for a complete installation.

B. Center all outlets with regard to building lines, furring and trim. Symmetrically arrange outlets in the room. Satisfactorily correct outlets improperly located or installed.

C. Set outlets plumb and extend flush outlets to the finished surface of the wall, ceiling or floor without projecting beyond same.

D. Install symmetrically all receptacles, switches and outlets shown on the trim and where necessary, set the long dimension of the plate horizontal or gang in tandem.

E. Outlets in outdoor areas or wet areas shall be GFI – provide GFI outlets in other areas as required by Code.

END OF SECTION

ELECTRICAL SYSTEM TEST REPORT - 600V CABLE

ELECTRICAL SYSTEM
DESCRIPTION DATA

SERVICE DESCRIPTION:
nominal voltage, phase to phase
phase to neutral - single or three phase-
number of conductors _____

SERVICE CONDUCTORS:
phase size and insulation type _____
neutral size and insulation type _____
ground size and insulation type _____

SERVICE DISCONNECT DESCRIPTION:
circuit breaker or disconnect switch _____
size (amps) _____
fuse (amps) _____

MEASURED CONDITIONS		DATA
Operating Load Voltage	Volts	Vab_____ Vbc_____ Vca_____
		Van_____ Vbn_____ Vcn_____
Operating Load Feeder Current	Amps	Ia_____ Ib_____ Ic_____
Conductor Insulation Resistance (record the indicated measurement for each of the following circuits:)	Megohms	a-b_____ b-c_____ c-a_____
	Megohms	a-g_____ b-g_____ c-g_____

1. Service Feeder
2. Pump Feeders

MOTOR DATA AND TEST REPORT

EQUIPMENT NAME AND NUMBER: _____

EQUIPMENT SPECIFICATION SECTION: _____

MOTOR STARTER LOCATION _____

CONTRACTORS REPRESENTATIVE _____ DATE _____

MOTOR NAMEPLATE DATA

MFR Name/Model No. _____
Voltage/Phase/HP _____
FLA/LRA _____
Service Factor _____
Efficiency Index (or percent) _____
NEMA Design _____
Code Letter _____
Insulation Type _____
Temperature Rise _____
Ambient Temperature _____
RPM _____
Enclosure _____
Thermal Trip Setting _____
Space HTR: Watts/Volts _____
Other Data _____

MOTOR STARTER INFORMATION
Manufacturer/Type _____
Overload Heater No _____

* RECORDED FULL LOAD DATA	VOLTS	A-G_____	B-G_____	C-G_____	
FULL LOAD OPERATING VOLTAGE	VOLTS	A-B_____	B-C_____	C-A_____	
FULL LOAD OPERATING CURRENT	AMPS	A_____	B_____	C_____	
INSULATION RESISTANCE (deenergized)	MEGOHMS	A-G_____	B-G_____	C-G_____	
MOTOR CIRCUIT RESISTANCE	OHMS	A-B_____	B-C_____	C-A_____	

* VOLTAGE & CURRENT READINGS SHALL BE TAKEN AT THE CLOSEST ACCESSIBLE POINT TO THE LOAD

END OF SECTION

SECTION 26 28 13.16
ENCLOSED SWITCHES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes switches and fusible switches in enclosures:

1. Utility Disconnect Switch.
2. Generator Disconnect Switch.
3. Manual Transfer Switch
4. HVAC Disconnect Switches (as required)

B. This section includes switches and circuit breakers, whether individually mounted or group mounted in switchboards, motor control centers, panelboards, and similar equipment.

1.02 SUBMITTALS

A. GENERAL: Submit each item in this Article as described in Section 26 00 00 – Electrical General, and Division 1.

B. ACTION SUBMITTALS

1. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    a. Wiring Diagrams: Power, signal, and control wiring.

C. INFORMATIONAL SUBMITTALS

1. Source quality-control test reports.
2. Field quality-control test reports.

D. CLOSEOUT SUBMITTALS

1. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

E. Submit circuit breaker information with or after the Electrical System Study Report (ESSR) as specified under Section 26 00 00 . Equipment submitted prior to submission of the ESSR will be returned as “Not Reviewed”. Circuit breaker equipment shall not be approved or ordered until the ESSR has been reviewed and approved.

F. PRODUCT DATA: For disconnect switches, circuit breakers and accessories specified in this Section. This includes, but is not limited to:

1. Specification sheets (cut sheets) of all proposed equipment (indicate the exact devices that are to be supplied).
2. nameplate ratings
3. mounting methods
4. For units which are stand-alone mounted include dimensioned plans (showing available conduit entry locations), sections, and elevations.
5. Enclosures which will not accept the quantities and sizes of conduits as shown on the Contract Plans will be rejected.
6. Lug configuration showing quantities and sizes of conductors equipment can accept. Lugs or connections for switches and circuit breakers which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.

G. FIELD TEST REPORTS: Indicate and interpret test results for compliance with performance requirements. (See Section 3.02 for further information)

H. OPERATION AND MAINTENANCE MANUAL: Shall include the following:

1. Maintenance Manuals (specified in Division 1).
2. Electrical System Study Report
3. Field Test Reports (see Section 3.02 for further information)
4. Product Data

1.03 QUALITY ASSURANCE

A. SOURCE LIMITATIONS: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.

B. Comply with NEC for components and installation.

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.

D. Comply with UL 98, “Enclosed and Dead-Front Switches” for safety switches.

E. PRODUCT SELECTION FOR RESTRICTED SPACE: Space for installation of switches and circuit breakers is limited. The Plans indicate typical physical sizes or dimensions for switches and circuit breakers, including clearances between switches and circuit breakers and adjacent surfaces and items. Switches with larger dimensions may be acceptable, but it is the responsibility of the Contractor to submit detailed drawings showing the required revisions to the structural, process, mechanical, electrical, and other plans to accommodate centers with larger dimensions in order to obtain approval before a change is accepted. The Supplier/Contractor shall coordinate the size of the switches and circuit breakers with the available space and shall verify that the proposed switches and circuit

breakers are capable of being installed in the available space prior to making a submittal. Switches and circuit breakers of dimensions larger than the available space shall not be submitted, and if is submitted, shall be rejected. The decision of the Owner as to the acceptability of switches and circuit breakers with larger dimensions than as shown on the Plans will be final. If the larger equipment is deemed acceptable, it is the Contractor's responsibility to provide any required revisions to the structural, process, mechanical, electrical, and other designs without additional cost to the Owner.

F. Submit and obtain approval of shop drawings and make approved shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with switch and circuit breaker access locations from approved shop drawings. Do not place conduits in slabs prior to the receipt of approved shop drawings. Any relocation of conduits that are required because of incorrectly placed conduits prior to receipt of approved shop drawings shall be completed at the Contractor's expense.

PART 2 : PRODUCTS

2.01 MANUFACTURERS

A. AVAILABLE MANUFACTURERS: Subject to compliance with requirements, manufacturers offering switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:

1. Disconnect switches, safety switches and circuit breakers:
    a. Eaton Corp.; Cutler-Hammer Products.
    b. General Electric Co.; Electrical Distribution and Control Division.
    c. Siemens Energy & Automation, Inc.
    d. Square D Co.

2.02 SWITCHES

A. Enclosed, Non-fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position. Switch horsepower rated where used in motor circuits.

B. Enclosed, Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, Class R rejection fuse clips, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position. Switch horsepower rated where used in motor circuits. Provide locking provisions to lock the switch in ON (CLOSED) and OFF positions.

C. Enclosed, 2-Way, Non-Fusible Switch, 400 A and Smaller: NEMA KS 1, Type HD, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position. Switch horsepower rated where used in motor circuits.

1. Provide auxiliary contacts to indicate when switch is in normal (e.g., connected to utility power supply) and are open otherwise.

D. ENCLOSURE: NEMA KS 1, with enclosure types as described in the Contract Documents. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans. Enclosure shall use spring loaded latches to ensure environmental protection in any position of the switch; the use of screw or bolt type securing is not acceptable for NEMA 1, 3, 3R, 4, 4X or 12 rated enclosures.

E. Lugs or connections shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.

F. ACCESSORIES

1. Provide at least two auxiliary contacts for each switch. Where no auxiliary contacts are shown on plans, provide two normally open auxiliary contacts. Where one auxiliary contact is shown on the plans, provide indicated auxiliary contact and one additional normally open auxiliary contact. If two or more auxiliary contacts are shown on the plans, provide auxiliary contacts as shown.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Install equipment enclosures level and plumb in locations as indicated, according to manufacturer's written instructions.

B. For wall mounted equipment enclosures located at walls, bolt units to wall or mount on structural–steel channels bolted to wall. For enclosures not located at walls, provide structural stanchion supports conforming to Section 26 05 29–Hangers and Supports for Electrical Systems .

C. Install wiring between switches, circuit breakers, control, and indication devices.

D. Connect switches and circuit breakers and components to wiring system and to ground as indicated and as instructed by manufacturer.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Identify each switch and circuit breaker according to requirements specified in Section 26 05 53 – Identification for Electrical Systems.

3.02 FIELD QUALITY CONTROL

A. ACCEPTANCE TESTING: After installing switches and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Provide services of a qualified independent testing agency if required.

a. Third party testing shall not commence until the Electrical System Study Report has been reviewed and approved.

2. Procedures:

   a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5.1.1 for switches. Certify compliance with test parameters.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.03 ADJUSTING

Provide fuses for fused disconnect switches to coordinate with manufacturer's listed maximum fuse size for equipment supplied by the disconnect switch.

3.04 CLEANING

After completing system installation, including fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION

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SECTION 26 29 13
MOTOR CONTROL EQUIPMENT

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Motor control equipment for this project consists of: Reduced Voltage Soft-Starters.

B. Provide the motor control equipment, interconnecting wiring and all related equipment.

C. Provide indicating lights, switches, meters, nameplates, and controls as shown on the drawings.

1.02 RELATED SECTIONS

A. Section 26 05 00 – Miscellaneous Electrical.

B. Section 26 22 00 – Low-Voltage Transformers.

C. Section 26 24 16 – Panelboards.

D. Section 40 61 13 – Process Control System General Requirements.

E. Section 40 67 00 – Control Panels.

1.03 STANDARDS AND CODES

A. 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. They shall be listed at the AIC ratings where installed on this project.

B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.

C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C.

1.04 SUBMITTALS

A. Submittal documents shall conform to the requirements of Section 1-06 – Control of Materials and Section 26 00 00 – Electrical General.

B. Submittals shall include the manufacturer’s name, address, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference. Include other information necessary to establish contract compliance of each item proposed to furnish.

C. Each item shall be clearly marked and provided with adequate sales and technical information to clearly show conformance with all aspects of the specification. Packages not provided as described above or largely incomplete shall be returned to the Contractor, without comment.

D. Provide the following project data:

1. System wiring diagrams for each motor controller including, but not limited to, the following: all instruments, relays, starters, switches, lights, breakers terminals, etc.
2. Indicate on submitted diagrams the terminals for remote devices as shown on the wiring diagrams in the contract drawings.
3. Wire and terminal numbers shall be included on the schematic diagrams.
4. Relay contacts shall be indicated for type and number available for each relay used.
5. Information on ratings and sizes of all equipment such as control transformers, fuses, breakers, etc. on the wiring diagrams for each motor controller.
6. Shop Drawings shall be provided on 11” x 17” sheets maximum size, and shall be scaled using standard engineering or architectural scales.
7. Connection diagrams showing physical wiring layout for each unit.
8. Technical data sheets for all components (relays, contactors, overloads, indicating lights, switches, circuit breakers, etc.) with the complete part number of the component clearly designated with all required options as specified in PART 2. Provide at a minimum one tab section for each product listed in PART 2 of this Section.
9. Scaled elevation drawings of the exterior and interior with all devices clearly labeled.
10. Bill of materials showing quantity, manufacturer, catalog number, and the supplier name and phone number for all components.
11. Overload relay heater tables.
12. Provide motor nameplate data of approved process equipment (for example, submersible pumps) with at least the following information:
    a. Motor nominal voltage.
    b. Motor full load amperage at nominal voltage.
    c. Motor locked rotor current.
    d. Motor maximum speed.
    e. Pump maximum speed.
    f. Pump minimum speed.
    g. Pump maximum acceleration rate (for example, minimum time for 0 to 60 hertz).
    h. Pump maximum deceleration rate (for example, maximum time for 60 to 0 hertz).

13. For each enclosure, provide the following information:

    a. Enclosure nominal voltage source power voltage.

    b. Equipment full load amperage (FLA) at nominal voltage.

    c. Equipment maximum overcurrent protective device (MOCP) rating. Unless noted otherwise, assume a thermal-magnetic circuit breaker with “D” type tripping characteristics.

    d. Size and quantity of lugs for incoming and outgoing power conductors. Include the range of wire gage rating of the lugs and if the lugs are suitable for terminating finely stranded wire.

1.05 COORDINATION OF EQUIPMENT

It is the Contractor's responsibility to coordinate equipment information with the motor controller manufacturer so that the correct type of motor starters and protection equipment are provided and sized properly for the devices being served and to supply such equipment with the proper protection. The Contractor shall verify that all motor control equipment will fit physically within the space allotted per the contract drawings.

1.06 COORDINATION WITH CONTROL SYSTEM

A. The motor controller equipment manufacturer shall equip the assembly with all appurtenances and accessories (including but not limited to control relays, control contacts, control wiring and terminal strips) as required by the Control System Integrator for interface with the main control system to provide a totally integrated and operable system.

B. The Control System Integrator, as specified in Section 40 61 13 – Process Control System General Provisions, shall responsible for coordination and integration of control system. The System Integrator shall determine all requirements for and shall cause integration of the control system and the motor controller into a unified operating system. The System Integrator will define all requirements for all interfacing equipment, appurtenances, and accessories as well as configuration of those devices to affect the desired control.

1.07 O&M DATA

Provide O&M data for all motor controllers and related equipment in accordance to the general requirements in Section 26 00 00 – Electrical General.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Acceptable Manufacturer’s shall be one of the following:

1. Eaton Electrical (Cutler Hammer).
2. Schneider Electric (Square D).
3. Rockwell Automation (Allen-Bradley).

B. The design shown on the drawings is based upon Eaton Electrical. Although any of the named products are very similar and should not require significant modification of the design, the Contractor shall be responsible for all costs associated with alterations to accommodate other named manufacturers, or those attributed to a proposed alternate manufacturer that may have any combinations of different size, characteristics, or configuration.

C. VENTILATION FANS

1. Provide vent fans as required for cooling. Vent fans may be provided with thermostats or other controls so they do not operate unless necessary.

2. All vents shall be provided with washable dust filters,

D. CONTROL POWER TRANSFORMERS

1. All motor starter units shall be equipped with a control circuit transformer, 120 VAC secondary with primary and secondary fuses and blown fuse indicators. The transformer shall be sized to accommodate the contactor(s) and all connected control circuit loads. The transformer size shall also accommodate any devices shown on the drawings as being served by the control circuit transformer.

E. TRANSIENT SUPPRESSORS

1. Provide all contactor coils with transient suppressors to limit the high voltage transients produced when power is removed from the coil. CUTLER HAMMER - C320AS1 or equal.

F. OVERCURRENT PROTECTION

1. Circuit breakers shall be molded case thermal-magnetic type. Circuit breakers other than those mounted in the panelboard shall be capable of being padlocked in the open position. Circuit breakers shall be quick-make and quick-break type. All breakers shall be calibrated for operation in an ambient temperature of 40^{O}C.

   a. Breakers shall have lugs UL listed for copper or copper and aluminum.

   b. Breakers shall have the interrupting rating and trip rating indicated on the drawings.

2. Fuses shall be 13/32 inch diameter, class CC or midget, rated for the voltage at which they are applied.

2.02 MOTOR STARTER

Motor starter units shall be of the combination type with components as indicated on the drawings. Magnetic contactors shall be heavy duty NEMA rated, Schneider Electric (Square D) type S, Rockwell Automation (Allen Bradley) Bulletin 509, or Eaton Electrical (Cutler Hammer) Freedom. All contactors shall be provided with two field convertible (normally open or normally closed) auxiliary contacts. An auxiliary switch shall be provided to indicate the circuit breaker is in the "ON" position. Motor starters and associated equipment shall be provided to match the load being served.

2.03 OVERLOAD RELAYS

Overload relays on starters shall be adjustable, solid state type with a minimum adjustment range of 3 to 1. Overload relays shall have selector for either auto or manual reset. Overload Relays shall monitor all energized conductors and shall trip on phase fail and ground fault. A Separate N.O. overload contact shall be provided in addition to standard N.C. overload contact. Overload relay shall be provided with a circuit test button which shall simulate an overload trip, trip indication, and reset pushbutton. Overload which trip on phase/power fail shall automatically reset upon normal power restoration. Siemens 3RB12, Allen-Bradley SMP-2 or equal.

2.04 REDUCED VOLTAGE SOFT STARTER

A. Reduced voltage soft starters (RVSS) shall limit the starting torque of the motor thereby reducing the current inrush.

B. Discrete input control signals shall be level sensing.

C. For RVSS units furnished with fans – provide controls or thermostats so that the fans do not operate unless the equipment is running or the temperature is high.

D. Configure RVSS so that a fault caused by a power failure, excluding internal component failures, will automatically reset when normal power returns. The RVSS will automatically restart if called without requiring a manual reset.

E. Provide source power for control of RVSS directly from the RVSS or from a dedicated CPT or power supply for each individual RVSS.

F. Provide relays as necessary for run, fail and other contacts for input to the PLC, indicator lights, louver/fan/heater controls etc.

G. If ventilation fans are required for cooling, provide thermostats or contact from RVSS for fan control so that the fan will only operate when the enclosure temperature is above the setpoint.

H. Provide enclosure mounted keypad module accessible from the exterior of the RVSS enclosure to access RVSS parameters without requiring exposure to line power voltage components or devices.

I. Provide remote network interface module capable of displaying device status on an integral to device web page. Interface module shall also provide status via Rockwell Automation Ethernet/IP and Schneider Electric Modbus TCP module.

2.05 OPERATING AND INDICATING DEVICES

A. Operating and indicating devices minimum rating shall be NEMA 1.

B. CONTROL RELAYS

1. Relays for general purpose use shall be DPDT or 3PDT, 10 amp contacts with the appropriate coil voltage for the application. They shall have an 8-pin base, matching socket, and contact status indicator. Units shall be Allen-Bradley Bulletin 700 type HA, HB or equal.

C. TIME DELAY RELAYS

1. Time delay relays shall be multi-function, multi-range with plug-in base, pin style terminations timing and timed out LED indicators, and calibrated scales. Relays shall have minimum .5 seconds to 60 minutes, 8 selectable timing ranges, 5 amp contacts. Select coil voltage for the application. Minimum accuracy requirements (plus or minus) shall be as follows: 1) Repeat accuracy 1/2% 2) Timing change over full voltage range 1/2% change over full temperature range 2% 3) Scale tolerance 5%. Allen-Bradley Bulletin 700 type HR series or equal. Appropriate relay shall be selected based on application from the control wiring diagrams

D. TERMINAL BLOCKS

1. Terminal boards shall be 300 or 600 volt modular terminal blocks with tubular screw and pressure plate. Terminal shall be sized to accept 2-#14 wire minimum. Provide a minimum of 20% or four (whichever is more) spare terminals in each enclosure. Allen-Bradley Bulletin 1492-CA1 or approved equal.

2.06 NAMEPLATES

A. Each motor controller enclosure shall have a nameplate designating the equipment and its device tag number and size or rating. Data shall be as shown on one-line diagrams. Nameplates shall be made of 1/16" thick machine engraved laminated phenolic having black letters not less than 3/16" high on a white background. Nameplates shall have name, number and/or function as is applicable for clear identification.

B. Equipment titles and numbers shall be completely spelled out on nameplates or as shown on the drawings. Nameplates on steel panels shall be secured with stainless steel drive screws. Where it is proposed that nameplates will be secured with pressure sensitive tape or bonding cement, the process and samples shall be submitted to the Engineer for acceptance.

C. Nameplates shall also be provided for identifying all relays and devices that are located inside the panels and shall be of the sandwich phenolic described above or equal.

D. Nameplates shall be mounted in a manner or location such that other equipment or devises do not block them so they are easily viewed.

E. Nameplates for motor data provided under Section 26 05 00 – Miscellaneous Electrical, "Identification for Electrical Systems", shall be mounted inside the door in the appropriate motor controller enclosure.

2.07 SURGE ARRESTORS

A. Provide Surge arrestors, with indicators, where shown on the one-line diagrams to protect against overvoltage transients. JOSLYN J9200 series with protective capacitor GE model 9L18 or equal. Select proper components for the application as shown on the drawings.

B. Provide surge protection on incoming service to building. Protection shall be with a TVSS. Total surge current 250,000, Surge current per phase 100,000, 10 modes of protection. Noise attenuation shall be minimum 60 dB @ 100 kHz, filter bandwidth 10 - 100 kHz, response time 1 nanosecond. Provide with form C contacts for remote monitoring and 6 digit surge counter. Filter shall be TYCOR, PTY25015 or equal. Mount in the panel per manufacturers recommendations.

2.08 OPERATING MECHANISMS

All circuit breakers in motor controller enclosures shall be provided with external "thru-the-door" operating handles. Schneider Electric Square D Class 9422, Allen-Bradley Bulletin 1494, or equal.

2.09 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:

1. 100% spare bulbs of each type used for indicating lights.
2. One spare control, time delay phase fail, etc. relay of each type used. or 20% whichever is the greater number.
3. One spare lens of each color used for indicating lights.
4. Two spare fuses for each fuse provided under 10 amps and one spare fuse for each fuse provided over 10 amps.
5. One spare overload relay for each type and size provided.

B. Spare parts shall be provided with the motor control equipment when shipped to the site.

PART 3 : EXECUTION

3.01 GENERAL

A. It is the Contractors responsibility to verify that the motor starters, protection equipment, and other components, etc. provided are suitable (correct phase, voltage, starter type, correct breakers, and overload relays) for the motors and equipment loads being served.

B. Operator interface devices such as metering and devices with control and displays shall be installed between 5’ and 5’-8”” above finished floor. Operator interface devices on full height sections shall be installed between 4’-6”and 6’ above finished floor.

C. All assembly and wiring not completed by the manufacturer or Integrator, due to shipping sections, multiple suppliers, etc. shall be the responsibility of the Contractor.

D. Freestanding motor controller equipment shall be installed to meet seismic zone 3 requirements according to the manufacturer’s recommendations.

E. Provide wire and terminal numbering on all wires and terminals.

F. Provide schematic and layout drawings for each individual unit.

3.02 TESTING

A. The motor controller equipment shall be tested in the system Integrator's shop along with the control system per the requirements in this section and 40 90 00 – Instrumentation and Controls. Operation of the motor controller equipment shall be tested in the shop by the Control System Integrator. The testing shall include, but not be limited to, operation of all input and output (I/O) points, control devices and motor controllers 24 hours per day for a continuous period of at least one (1) week.

B. Testing and inspection of the motor controller equipment shall include all components. All motor controllers shall be interconnected with the control system and powered with rated incoming voltage.

C. After completion of initial testing, the Control System Integrator shall conduct subsequent testing for inspection by the Engineer. The Control System Integrator shall provide for time, equipment and support in their shop for the Engineer to test the motor controller equipment for a period of up to 3 days. All control functions and all status and alarm monitoring and indication shall be demonstrated under simulated operating conditions. Simulating equipment shall be provided and wired into the motor controller equipment system for this testing. The Control System Integrator shall revise, modify, adjust the system as required by the Engineer during the testing period.

3.03 INSTALLATION

A. The motor controller equipment shall not be shipped to the site until it has been inspected by the Contractor and tested to the satisfaction of the Engineer (See Section 26 08 13 – Electrical Demonstration for requirements) and a suitable environment is available for installation of the equipment. A suitable environment for the purposes of this contract for the motor controller equipment shall be dry, covered and heated to maintain a minimum ambient temperature of 60 degrees F. Prior to shipment of electrical equipment, the Contractor shall contact the Engineer for field verification of a suitable environment.

B. The motor controller equipment shall be installed in accordance with the installation drawings and instructions. Installation shall be performed by workers who are skilled and experienced in the installation of motor control equipment. It is the contractor's responsibility to provide sufficient space for the equipment and size of equipment to fit within the space requirements and meet all code requirements.

C. Provide a 2" thick concrete house keeping pad under the entire freestanding motor controller equipment.

D. Installation shall include all elements and components of motor control equipment and all conduit and interconnecting wiring between all elements, components, and sensors. All wiring between cabinets, sensors, pumps and equipment shall be multiple color coded with at least twenty individual colors for ease of servicing. All terminations shall be made with solderless pressure connectors. All wiring shall be in accordance with the requirements of Section 26 05 00. Intrinsically safe wiring shall be separated with barriers per NEC requirements.

3.04 COMMISSIONING

A. SERVICES OF MANUFACTURER

1. General: An authorized service representative of the manufacturer shall be present at the Site for two 1/2 Days to furnish the services listed below. For the purpose of this paragraph, a ½ Day is defined as a 4 hour period excluding travel time.

2. 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.

   a. Installation of the equipment

   b. Inspection, checking, and adjusting the equipment

   c. Startup and field testing for proper operation

   d. Performing field adjustments such that the equipment installation and operation comply with requirements.

3. Instruction of Owner's Personnel: The authorized representative shall instruct the Owner's personnel in the operation and maintenance and configuration 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 3 weeks in advance of the first session. Training session shall be 2 hours minimum. Training shall include individual two sessions for 2 shifts of plant personnel (2 hours for each session). Proposed training materials shall be submitted for review, and comments shall be incorporated. Training materials shall remain with the trainees. The Owner may videotape the training for later use with the Owner's personnel.

3.05 WIRING

A. Refer to Section 26 05 00.

B. Separately bundle all signal, low voltage, and control wiring from 120V and 480V power wiring and maintain a minimum of 1-inch separation of conductors of different voltage.

END OF SECTION

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SECTION 26 29 13.11
ACROSS-THE-LINE CONTACTORS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This section specifies the requirements for magnetic contactors.

1.02 STANDARDS AND CODES

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
2. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
3. NEMA AB 1 - Molded Case Circuit Breakers.
4. NEMA KS 1 - Enclosed Switches.
5. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.03 SUBMITTALS

A. PRODUCT DATA

1. Submit manufacturer’s product data.

B. RECORD DOCUMENTS

1. Submit dimensioned Drawings showing size, circuit breaker, fusible switch and equipment ratings including, but not limited to, voltage, bus ampacity, integrated short circuit ampere rating.
2. Provide data on relays, pilot devices, switching and overcurrent protection.
3. Indicate enclosure NEMA rating and material.

C. OPERATION AND MAINTENANCE DATA

1. Provide operating and maintenance manuals.

PART 2 : PRODUCTS

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Provide enclosure for each contactor.

C. All equipment provided under this section must be from the same manufacturer. The manufacturer must be one of the following:

1. Rockwell Automation (Allen-Bradley).
2. Schneider Electric (Square D)
3. Eaton Electrical (formerly Cutler-Hammer)

2.02 CONTACTOR

A. Provide each device with proper contactor equipment.

1. Contactor, unless specified or scheduled to the contrary, shall be provided by the trade furnishing the motor.
2. All motor starting equipment provided by any one trade shall be of the same manufacturer unless such starting equipment is an integral part of the equipment on which the motor is mounted.
3. Provide contactors in Motor-Control Centers per requirements of Section 26 24 19 – Motor-Control Centers.

B. MAGNETIC CONTACTOR

1. Contactor:
   a. Size contactors according to NEMA standards or as shown; however, minimum shall be size 1.
   b. Provide main pole in each phase leg, the number and type of auxiliary contacts to perform the required functions, and two (2) spare auxiliary contacts, one (1) normally open and one (1) normally closed.
   c. Use double break contacts of silver-cadmium oxide or similar material to minimize sticking or welding.
   d. Provide contactor coils suitable for continuous operation at 120 volts, 60 hertz or 24 volts, direct current as indicated on the plans.
2. Enclosure: Provide a NEMA 1 enclosure unless otherwise indicated on Drawings.

3. Control Devices: Provide control devices as indicated on the Drawings, in front of enclosure as follows:

   a. Selector Switches: Heavy-duty, oil-tight, maintained contact, 3-position, with marked nameplate HAND-OFF-AUTOMATIC, unless otherwise indicated on two speed motors provide OFF-LOW-HI selector switch.

   b. Indicating Lights: Indicating lights shall be heavy-duty LED type. Neon lamps are not acceptable. Provide red (running) lens. On two-speed starters, provide amber (low speed) and red (high speed).

C. MANUAL CONTACTOR: Provide line voltage manual motor starters for each phase of the indicated.

2.03 DISCONNECTING MEANS AND OVERCURRENT PROTECTIVE DEVICES:

A. MCP DISCONNECTING MEANS

1. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
3. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
4. NC alarm contact that operates only when MCP has tripped or is opened.

B. MCCB DISCONNECTING MEANS

1. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
2. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
3. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
4. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
5. NC alarm contact that operates only when MCCB has tripped or is opened.

C. COMBINATION FUSED SWITCH-CONTACTOR

1. Type: Provide combination fused switch and magnetic motor started as indicated on the Drawings.
2. Fuses: 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.

3. Molded Case Circuit Breaker: Provide motor circuit protector (MCP) type of circuit breaker. Arrange with an operator capable.
4. Starter: Provide magnetic motor starter as specified herein.
5. Enclosure: Provide a NEMA 1 enclosure unless otherwise indicated on Drawings.

2.04 CONTROL POWER:

A. CONTROL CIRCUITS: 120-V ac; obtained from integral CPT or power supply, with primary and secondary fuses, with CPT or power supply of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

1. CPT Spare Capacity: 100 VA or 50 W.

B. CONTROL POWER TRANSFORMER

1. Voltage: Provide in each enclosure a single-phase control power transformer with a 480-volt primary and a 120-volt secondary
2. Fuses:
   a. Fuse both primary lines of the transformer and connect to Line 1 and Line 2.
   b. Fuse the secondary line leaving transformer terminal X1.
   c. Ground the line leaving terminal X2.
   d. Use rejection-type fuse clips and RK-1 type current limiting fuses on the primaries.
   e. Coordinate primary fuses with secondary fuse to clear a faulted transformer but not blow on magnetizing in-rush current.
3. Size: Provide manufacturer’s standard size transformer unless the manufacturer of vibration switches requires a larger size.

C. POWER SUPPLY

1. Voltage: Provide in each enclosure a single-phase control power transformer with a 480-volt primary and a 24-volt direct current secondary

PART 3 : EXECUTION

3.01 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer’s published recommendations.

C. Anchor assembly to housekeeping pad.

D. Adjust operating mechanisms for free mechanical movement.

E. Touch-up scratched or marred surfaces to match original finish.

F. Identify contacts as to equipment served with engraved laminated phenolic nameplates. Refer to Section 26 05 53 – Identification for Electrical Systems for nameplate information.

3.02 TESTING

A. Subsequent to wire and cable connections, energize motor controllers and demonstrate functioning in accordance with manufacturer's requirements.

B. Engage an independent testing agency and perform the testing described in NETA ATS including the tests noted as "optional".

1. Follow manufacturer's instructions for solid state overload relays; insulation testing may not be required for the portions of the pilot circuit where the solid-state components may not be isolated.

END OF SECTION

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SECTION 26 29 13.13
ACROSS-THE-LINE MOTOR CONTROLLERS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies the requirements for magnetic motor starters.

1. Full voltage, non-reversing combination magnetic motor starters,
2. Full voltage, reversing combination magnetic motor starters.

B. This section specifies the requirements for manual motor starters.

1. Full voltage magnetic motor starters.

1.02 REFERENCES

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
2. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
3. NEMA AB 1 - Molded Case Circuit Breakers.
4. NEMA KS 1 - Enclosed Switches.
5. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.03 SUBMITTALS

A. PRODUCT DATA

1. Submit manufacturer’s product data.

B. RECORD DOCUMENTS

1. Submit dimensioned Drawings showing size, circuit breaker, fusible switch and combination starter arrangement and equipment ratings including, but not limited to, voltage, bus ampacity, integrated short circuit ampere rating.
2. Provide data on relays, pilot devices, switching and overcurrent protection.
3. Indicate enclosure NEMA rating and material.

C. OPERATION AND MAINTENANCE DATA

1. Provide operating and maintenance manuals.

PART 2 : PRODUCTS

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state, and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Provide enclosure for each motor controller

C. All equipment provided under this section must be from the same manufacturer. The manufacturer must be one of the following:

1. Rockwell Automation (Allen-Bradley).
2. Schneider Electric (Square D)
3. Eaton Electrical (formerly Cutler-Hammer)

2.02 MOTOR STARTERS

A. Each motor shall be provided with proper starting equipment.

1. Starting equipment, unless specified or scheduled to the contrary, shall be provided by the trade furnishing the motor.
2. All motor starting equipment provided by any one trade shall be of the same manufacturer unless such starting equipment is an integral part of the equipment on which the motor is mounted.
3. Furnish all motor starters required. Provide motor control centers in accordance with Section 26 24 19; provide motor starters in accordance with this section.
4. All applicable motors shall be compatible with variable speed motor controller. Variable speed motor controllers shall be furnished with the drive equipment, run tested and certified at factory prior to shipping. Certified tests shall be submitted to Owner with submittals.

B. MAGNETIC MOTOR STARTER

1. Type: Provide magnetic, full-voltage, non-reversing motor starters unless otherwise indicated.
2. Overload Relays: Provide an ambient-compensated thermal overload relay in each phase leg.
    a. Overload relay shall be solid state style.

b. Overload relay shall connect to an Ethernet network through Cat-5e or Cat-6 cabling and make status and statistical information available using Modbus TCP or Rockwell Automation Ethernet/IP.

3. Contactor:

a. Size contactors according to NEMA standards or as shown; however, minimum shall be size 1.

b. Provide main pole in each phase leg, the number and type of auxiliary contacts to perform the required functions, and two (2) spare auxiliary contacts, one (1) normally open and one (1) normally closed.

c. Use double break contacts of silver-cadmium oxide or similar material to minimize sticking or welding.

d. Provide contactor coils suitable for continuous operation at 120 volts, 60 hertz or 24 volts, direct current as indicated on the plans.

4. Enclosure: Provide a NEMA 1 enclosure unless otherwise indicated on Drawings.

5. Control Devices: Provide control devices as indicated on the Drawings, in front of enclosure as follows:

a. Selector Switches: Heavy-duty, oil-tight, maintained contact, 3-position, with marked nameplate HAND-OFF-AUTOMATIC, unless otherwise indicated on two speed motors provide OFF-LOW-HI selector switch.

b. Indicating Lights: Indicating lights shall be heavy-duty LED type. Neon lamps are not acceptable. Provide red (running) lens. On two-speed starters, provide amber (low speed) and red (high speed).

C. COMBINATION FUSED SWITCH-STARTER

1. Type: Provide combination fused switch and magnetic motor started as indicated on the Drawings.

2. Fuses: 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.

3. Molded Case Circuit Breaker: Provide motor circuit protector (MCP) type of circuit breaker. Arrange with an operator capable.

4. Starter: Provide magnetic motor starter as specified herein.

5. Enclosure: Provide a NEMA 1 enclosure unless otherwise indicated on Drawings.

D. MANUAL MOTOR STARTERS: Provide line voltage manual motor starters for each single-phase motor. Include bimetallic thermal overload protection in each ungrounded phase leg. Provide the toggle-operated starter in a NEMA 1 enclosure unless otherwise indicated.

E. ETHERNET NETWORK CONNECTION

1. Provide built-in, embedded web server capable of displaying measured and accumulated values described above.
2. Provide built-in, embedded gateway capable of transmitting measured, status and diagnostic information through Rockwell Automation Ethernet/IP or Modbus TCP.
3. Connection must be compatible with Cat-5e or Cat-6 cabling.

2.03 DISCONNECTING MEANS AND OCPDS

A. MCP DISCONNECTING MEANS

1. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
3. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
4. NC alarm contact that operates only when MCP has tripped or is opened.

B. MCCB DISCONNECTING MEANS

1. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
2. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
3. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
4. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
5. NC alarm contact that operates only when MCCB has tripped or is opened.

2.04 OVERLOAD RELAYS

A. SOLID-STATE OVERLOAD RELAYS

1. Switch or dial selectable for motor running overload protection.
2. Sensors in each phase.
3. Class 10 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

B. NC isolated overload alarm contact.

C. External overload reset push button.

D. ETHERNET CONNECTION

1. Protocols
    a. Modbus TCP
    b. Ethernet IP
2. Measured Values
    a. Amperage usage per phase
    b. Percent of thermal Capacity
    c. Discrete status monitor
    d. Active fault code

E. REMOTE DISCRETE STATUS MONITORING

1. Motor Contactor Closed (Auxiliary Contact)
2. Overcurrent protection/unit disconnect closed (not tripped)

F. POWER SUPPLY

1. Communications module must be powered from internal control bus with provisions to accept power from external power supply.

2.05 CONTROL POWER

A. CONTROL CIRCUITS: 120-V ac; obtained from integral CPT or power supply, with primary and secondary fuses, with CPT or power supply of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

1. CPT Spare Capacity: 100 VA or 50 W.

B. CONTROL POWER TRANSFORMER

1. Voltage: Provide in each enclosure a single-phase control power transformer with a 480-volt primary and a 120-volt secondary
2. Fuses:
    a. Fuse both primary lines of the transformer and connect to Line 1 and Line 2.
    b. Fuse the secondary line leaving transformer terminal X1.
    c. Ground the line leaving terminal X2.
    d. Use rejection-type fuse clips and RK-1 type current limiting fuses on the primaries.
    e. Coordinate primary fuses with secondary fuse to clear a faulted transformer but not blow on magnetizing in-rush current.
3. Size: Provide manufacturer’s standard size transformer unless the manufacturer of vibration switches requires a larger size.

C. POWER SUPPLY

1. Voltage: Provide in each enclosure a single-phase control power transformer with a 480-volt primary and a 24-volt direct current secondary

PART 3 : EXECUTION

3.01 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. Anchor assembly to housekeeping pad.

D. Select overload heaters for motor in accordance with manufacturer's recommendations for the voltage and full load amperes listed on the nameplate data of each motor actually installed.

E. Adjust operating mechanisms for free mechanical movement.

F. Touch-up scratched or marred surfaces to match original finish.

G. Individual motor starters are furnished under this Section. The installation and all connections are to be done under Division 26, similar to the Work done for motors served from a Motor Control Center.

H. Identify starters as to equipment served with engraved laminated phenolic nameplates. Refer to Section 26 05 53 – Identification for Electrical Systems for nameplate information.

3.02 TESTING

A. Subsequent to wire and cable connections, energize motor controllers and demonstrate functioning in accordance with manufacturer's requirements.

B. Engage an independent testing agency and perform the testing described in NETA ATS including the tests noted as "optional".

1. Follow manufacturer's instructions for solid state overload relays; insulation testing may not be required for the portions of the pilot circuit where the solid-state components may not be isolated.

END OF SECTION

SECTION 26 29 13.16
REDUCED-VOLTAGE MOTOR CONTROLLERS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies the requirements for magnetic motor starters.

1. Full voltage, non-reversing combination magnetic motor starters,
2. Full voltage, reversing combination magnetic motor starters.

B. This section specifies the requirements for manual motor starters.

1. Full voltage magnetic motor starters.

1.02 STANDARDS AND CODES

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
2. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
3. NEMA AB 1 - Molded Case Circuit Breakers.
4. NEMA KS 1 - Enclosed Switches.
5. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.03 SUBMITTALS

A. PRODUCT DATA

1. Submit manufacturer’s product data.

B. RECORD DOCUMENTS

1. Submit dimensioned Drawings showing size, circuit breaker, fusible switch and combination starter arrangement and equipment ratings including, but not limited to, voltage, bus ampacity, integrated short circuit ampere rating.
2. Provide data on relays, pilot devices, switching and overcurrent protection.
3. Indicate enclosure NEMA rating and material.

C. OPERATION AND MAINTENANCE DATA

1. Provide operating and maintenance manuals.

PART 2 : PRODUCTS

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state, and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Provide enclosure for each motor controller.

C. All equipment provided under this section must be from the same manufacturer. The manufacturer must be one of the following:

1. Rockwell Automation (Allen-Bradley).
2. Schneider Electric (Square D)
3. Eaton Electrical (formerly Cutler-Hammer)

2.02 MOTOR STARTERS

A. Provide each motor controller with proper starting equipment.

1. Starting equipment, unless specified or scheduled to the contrary, shall be provided by the trade furnishing the motor.
2. All motor starting equipment provided by any one trade shall be of the same manufacturer unless such starting equipment is an integral part of the equipment on which the motor is mounted.
3. All applicable motors shall be compatible with variable speed motor controller. Variable speed motor controllers shall be furnished with the drive equipment, run tested and certified at factory prior to shipping. Certified tests shall be submitted to Owner with submittals.

B. MAGNETIC MOTOR STARTER

1. Type: Provide magnetic, full-voltage, non-reversing motor starters unless otherwise indicated.
2. Overload Relays: Provide an ambient-compensated thermal overload relay in each phase leg.
    a. Overload relay shall be solid state style.
    b. Overload relay shall connect to an Ethernet network through Cat-5e or Cat-6 cabling and make status and statistical information available using Modbus TCP or Rockwell Automation Ethernet/IP.
3. Contactor:
    a. Size contactors according to NEMA standards or as shown; however, minimum shall be size 1.

b. Provide main pole in each phase leg, the number and type of auxiliary contacts to perform the required functions, and two (2) spare auxiliary contacts, one (1) normally open and one (1) normally closed.

c. Use double break contacts of silver-cadmium oxide or similar material to minimize sticking or welding.

d. Provide contactor coils suitable for continuous operation at 120 volts, 60 hertz or 24 volts, direct current as indicated on the plans.

4. Enclosure: Provide a NEMA 1 enclosure unless otherwise indicated on Drawings.

5. Control Devices: Provide control devices as indicated on the Drawings, in front of enclosure as follows:

a. Selector Switches: Heavy-duty, oil-tight, maintained contact, 3-position, with marked nameplate HAND-OFF-AUTOMATIC, unless otherwise indicated on two speed motors provide OFF-LOW-HI selector switch.

b. Indicating Lights: Indicating lights shall be heavy-duty LED type. Neon lamps are not acceptable. Provide red (running) lens. On two-speed starters, provide amber (low speed) and red (high speed).

C. COMBINATION FUSED SWITCH-STARTER

1. Type: Provide combination fused switch and magnetic motor started as indicated on the Drawings.

2. Fuses: 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.

3. Molded Case Circuit Breaker: Provide motor circuit protector (MCP) type of circuit breaker. Arrange with an operator capable.

4. Starter: Provide magnetic motor starter as specified herein.

5. Enclosure: Provide a NEMA 1 enclosure unless otherwise indicated on Drawings.

D. MANUAL MOTOR STARTERS: Provide line voltage manual motor starters for each single-phase motor. Include bimetallic thermal overload protection in each ungrounded phase leg. Provide the toggle-operated starter in a NEMA 1 enclosure unless otherwise indicated.

E. ETHERNET NETWORK CONNECTION

1. Provide built-in, embedded web server capable of displaying measured and accumulated values described above.

2. Provide built-in, embedded gateway capable of transmitting measured, status and diagnostic information through Rockwell Automation Ethernet/IP or Modbus TCP.

3. Connection must be compatible with Cat-5e or Cat-6 cabling.

2.03 DISCONNECTING MEANS AND OCPDS

A. MCP DISCONNECTING MEANS

1. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
3. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
4. NC alarm contact that operates only when MCP has tripped or is opened.

B. MCCB DISCONNECTING MEANS

1. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
2. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
3. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
4. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
5. NC alarm contact that operates only when MCCB has tripped or is opened.

2.04 OVERLOAD RELAYS

A. SOLID-STATE OVERLOAD RELAYS

1. Programmable, switch, or dial selectable for motor running overload protection.
2. Sensors in each phase.
3. Class 10 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

B. Normally closed, isolated overload alarm contact.

C. External overload reset push button.

1. Also accept dry contact to reset soft starter from PLC controlled relay contact.

D. ETHERNET CONNECTION

1. Protocols
   a. Modbus TCP

b. Ethernet IP

c. Coordinate with System Integrator on which protocol to select.w

2. Measured Values

a. Amperage usage per phase

b. Percent of thermal Capacity

c. Discrete status monitor

d. Active fault code

E. REMOTE DISCRETE STATUS MONITORING

1. Motor Contactor Closed (Auxiliary Contact)

2. Overcurrent protection/unit disconnect closed (not tripped)

F. POWER SUPPLY

1. Communications module must be powered from internal control bus with provisions to accept power from external power supply.

2.05 CONTROL POWER

A. CONTROL CIRCUITS: 120-V ac; obtained from integral CPT or power supply, with primary and secondary fuses, with CPT or power supply of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

1. CPT Spare Capacity: 100 VA or 50 W.

B. CONTROL POWER TRANSFORMER

1. Voltage: Provide in each enclosure a single-phase control power transformer with a 480-volt primary and a 120-volt secondary

2. Fuses:

a. Fuse both primary lines of the transformer and connect to Line 1 and Line 2.

b. Fuse the secondary line leaving transformer terminal X1.

c. Ground the line leaving terminal X2.

d. Use rejection-type fuse clips and RK-1 type current limiting fuses on the primaries.

e. Coordinate primary fuses with secondary fuse to clear a faulted transformer but not blow on magnetizing in-rush current.

3. Size: Provide manufacturer’s standard size transformer unless the manufacturer of vibration switches requires a larger size.

C. POWER SUPPLY

1. Voltage: Provide in each enclosure a single-phase control power

transformer with a 480-volt primary and a 24-volt direct current secondary

PART 3 : EXECUTION

3.01 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. Anchor assembly to housekeeping pad.

D. Select overload heaters for motor in accordance with manufacturer's recommendations for the voltage and full load amperes listed on the nameplate data of each motor actually installed.

E. Adjust operating mechanisms for free mechanical movement.

F. Touch-up scratched or marred surfaces to match original finish.

G. Individual motor starters are furnished under Section 26 29 13.13 – Across-the-Line Motor Starters. The installation and all connections are to be done under Division 26 (Electrical), similar to the Work done for motors served from a Motor Control Center.

H. Identify starters as to equipment served with engraved laminated phenolic nameplates. Refer to Section 26 05 53 – Identification for Electrical Systems for nameplate information.

3.02 TESTING

A. Subsequent to wire and cable connections, energize motor controllers and demonstrate functioning in accordance with manufacturer's requirements.

B. Engage an independent testing agency and perform the testing described in NETA ATS including the tests noted as "optional".

1. Follow manufacturer's instructions for solid state overload relays; insulation testing may not be required for the portions of the pilot circuit where the solid-state components may not be isolated.

END OF SECTION

SECTION 26 32 00
POWER GENERATION

PART 1 : GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. This Section includes packaged engine-generator sets for standby power supply with the following features:

1. Diesel gas engine.
2. Unit-mounted cooling system.
3. Unit-mounted control and monitoring.
4. Engine combustion exhaust silencer.

B. Related Sections include the following:

1. Section 26 36 00 – Load Transfer Switches (ATS) for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.03 DEFINITIONS

A. OPERATIONAL BANDWIDTH: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. DIESEL: Fuel Oil 2 Diesel.

1.04 ACTION SUBMITTALS

A. PRODUCT DATA: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.

B. SHOP DRAWINGS: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.

4. Wiring Diagrams: Power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. MANUFACTURER SEISMIC QUALIFICATION CERTIFICATION: Submit certification that engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. QUALIFICATION DATA: For installer and manufacturer.

C. Source quality-control test reports.

1. Certified summary of prototype-unit test report.

2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

3. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.

4. Report of sound generation.

5. Report of exhaust emissions showing compliance with applicable regulations.

6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

D. Field quality-control test reports.

E. WARRANTY: Special warranty specified in this Section.

1.06 CLOSEOUT SUBMITTALS

A. OPERATION AND MAINTENANCE DATA: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Div 1, include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Engine Drive Belts: One complete set of belts beyond those scheduled for replacement during initial warranty period.

1.08 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. MANUFACTURER QUALIFICATIONS: A qualified manufacturer. Maintain, within 100 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. SOURCE LIMITATIONS: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

D. 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.

E. Comply with ASME B15.1.

F. Comply with NFPA 37.

G. Comply with NFPA 70.

H. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

I. Comply with UL 2200.

J. ENGINE EXHAUST EMISSIONS: Comply with applicable state and local government requirements.

K. NOISE EMISSION: Overall sound dB(A) shall be 88.8 or less at 7 meters for unhoused engine.

1.09 PROJECT CONDITIONS

A. INTERRUPTION OF EXISTING ELECTRICAL SERVICE: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than 7 days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

B. ENVIRONMENTAL CONDITIONS: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.
2. Altitude: Sea level to 1000 feet (300 m).

1.10 COORDINATION

Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. SPECIAL WARRANTY: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: two years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

INITIAL MAINTENANCE SERVICE: Beginning at Substantial Completion, provide 12 months full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment. Service shall include complete system inspection and functional review of generator critical components, inspection of battery system, fuel system, engine system, engine lubrication system, intake/exhaust system, generator controls and power connections, and generator and automatic transfer switch operation.

PART 2 : PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer shall be one of the following, no substitutions.

1. Cummins Power Generation.
2. Caterpillar; Electric Power Generation.

B. The equipment of the manufacturer selected must fit within the space restrictions as shown on the Drawings.

B. The design shown on the drawings is based upon Caterpillar. Although all named products are very similar and should not require significant modification of the design, the Contractor shall be responsible for all costs associated with alterations to accommodate other named manufacturers, or those attributed to a proposed alternate manufacturer that may have any combinations of different size, characteristics or configuration.

2.02 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. MOUNTING FRAME: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

C. CAPACITIES AND CHARACTERISTICS

1. Power Output Ratings: Nominal ratings as indicated.
2. Output Connections: Three-phase, four wires.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. GENERATOR-SET PERFORMANCE

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.

2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.

3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.

4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.

6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.03 ENGINE

A. FUEL: Diesel (Fuel Oil #2).

B. RATED ENGINE SPEED: 1800 rpm.

C. LUBRICATION SYSTEM: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.

2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.

3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. ENGINE FUEL SYSTEM

1. Diesel Fuel: Provide the following:

a. Fuel-Shutoff Solenoid Valve (coordinate voltage with battery).

b. Flexible Fuel Connector.

c. Fuel pump:

1) Minimum of 10 foot of net positive suction head at full fuel rate.

2) Powered from battery voltage.

E. ENGINE BLOCK HEATER: 208 volts, 60 hertz, 30 amperes or less. Wired to accessory terminal box and controlled by engine control panel to heat windings if generator is not in use and ambient falls below a setpoint temperature.

F. COOLING SYSTEM: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. MUFFLER/SILENCER: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. Sized to limit noise emissions of engine combustion exhaust to 75 decibels $dB_{(A)}$ at 23 feet from exhaust.

H. AIR-INTAKE FILTER: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. STARTING SYSTEM: 12-Volt or 24-volt electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Include accessories required to support and fasten batteries in place.

7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

J. BATTERY CHARGER: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

1. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

2. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.

3. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.

4. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.

5. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

6. Enclosure: NEMA 250, Type 1.

7. Mounting: Within or attached to Automatic Transfer Switch

2.04 CONTROL AND MONITORING

A. AUTOMATIC STARTING SYSTEM SEQUENCE OF OPERATION: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. CONFIGURATION: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel features shall include the following:

1. Wall-Mounting Cabinet Construction: Rigid, self-supporting steel unit complying with NEMA ICS 6. Power bus shall be copper. Bus, bus supports, control wiring, and temperature rise shall comply with UL 891.
2. Current and Potential Transformers: Instrument accuracy class.

C. INDICATING AND PROTECTIVE DEVICES AND CONTROLS

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.
10. Start-stop switch.
11. Overspeed shutdown device.
12. Coolant high-temperature shutdown device.
13. Coolant low-level shutdown device.
14. Oil low-pressure shutdown device.

D. SUPPORTING ITEMS: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

E. ETHERNET DATA CONNECTION: Provide converter device to allow access from a computer based SCADA monitoring package using Ethernet, Category 5e or better copper cabling.

1. The interface shall be located within the engine generator control panel enclosure or within the automatic transfer switch enclosure.
2. Provide bus communications interface capable of transmitting registers using Rockwell Automation Ethernet IP protocol to Allen-Bradley Compact Logix. A SCADA monitoring package, such as Kepware I/O Server, must be able to retrieve all engine alarms described in NFPA 110 through interface.
3. A http web-page, served from the converter device, shall display current engine generator status including alarms, voltages, capacity and other information.

F. STATUS RELAY CONTACTS: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication for integration with the plant control panel.

1. Standby Engine Generator Run – Normally Open contact shall close to indicate that the Engine Generator is running. The Normally Open contact shall be open when the Engine Generator is not running.
2. Standby Engine Generator Fail – Normally Open contact shall close to indicate an Engine Generator failure. The Normally Open contact shall be open when the Engine Generator is OK; normal.
3. Standby Engine Generator Low Fuel – Normally Open contact shall close to indicate that the Engine Generator low fuel is detected. The Normally Open contact shall be open when the Engine Generator fuel level is above the low level.
4. Standby Engine Generator Not-In-Auto – Normally Open contact shall close to indicate that the Engine Generator start circuit is not in the "Auto position. The Normally Open contact shall be open when the Engine Generator control is in "Auto" position.
5. Standby Engine Generator Trouble – Normally Open contact shall close to indicate trouble with the Engine Generator. The Normally Open contact shall be open when the Engine Generator is OK.
6. Generator Overload Warning – Normally Open contact shall close to indicate that the engine generator power output is within 95% of the maximum rating and is open otherwise.
7. Battery-charger malfunction alarm– Normally Open contact shall close to indicate that the engine generator external battery charger is in an alarm state and is open otherwise.
8. Battery low-voltage alarm – Normally Open contact shall close to indicate that the engine generator starting voltage battery has a low voltage and is open otherwise.
9. Circuit breaker auxiliary – Normally Open contact shall close to indicate that the engine generator circuit breaker is closed and is open otherwise.

2.05 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. GENERATOR CIRCUIT BREAKER: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Enclosure: NEMA 250, type 1.
4. Mounting: Wall mounted to adjacent wall.
5. Auxiliary contact for monitoring circuit breaker. Contact must be closed when the circuit breaker is closed and opened otherwise.

2.06 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. DRIVE: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. ELECTRICAL INSULATION: Class H or Class F.

D. STATOR-WINDING LEADS: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. ENCLOSURE: Dripproof.

G. VOLTAGE REGULATOR: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

H. WINDINGS HEATER: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.07 VIBRATION ISOLATION DEVICES

A. ELASTOMERIC ISOLATION PADS

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Vibration Eliminator Co., Inc.
    g. Vibration Isolation.
    h. Vibration Mountings & Controls, Inc.
2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth pattern.

2.08 SOURCE QUALITY CONTROL

A. PROTOTYPE TESTING: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. PROJECT-SPECIFIC EQUIPMENT TESTS: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
6. Single-step load pickup.
7. Safety shutdown.

PART 3 : EXECUTION

3.01 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 03 30 00 – Cast-in-Place Concrete.

1. Comply with requirements for vibration isolation devices specified in this section.

D. ELECTRICAL WIRING: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

C. Connect engine exhaust pipe to engine with flexible connector.

D. Connect fuel piping to engines with a gate valve and union and flexible connector.

3.04 FIELD QUALITY CONTROL

A. TESTING AGENCY: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. MANUFACTURER'S FIELD SERVICE: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. TESTS AND INSPECTIONS

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
    a. Run engine at rated load for a minimum of 4 hours.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

G. LEAK TEST: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

H. OPERATIONAL TEST: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

J. Remove and replace malfunctioning units and retest as specified above.

K. RETEST: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

L. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.05 DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION

SECTION 26 35 33
POWER FACTOR CORRECTION EQUIPMENT

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies equipment and installation for harmonic mitigation used for power conditioning.

1. Provide one line-harmonic filter between each variable frequency drive and power supply:

a. Pump 1

b. Pump 2

c. Pump 3

2. The harmonic filter shall treat all characteristic low frequency harmonics generated by a three-phase full wave converter load (5^{th}, 7^{th}, 11^{th}, 13^{th}, etc.) Filter shall reduce total harmonic current distortion (THD_i) from a 6-pulse variable frequency drive (VFD) to comply with IEEE 519 acceptable levels when associated VFD operates at full load and the power distribution system has 3% or less voltage imbalance.

B. This section specifies equipment and installation for harmonic mitigation used for motor branch circuit conditioning.

1. Provide one load filter between each variable frequency drive and pump motor:

a. Pump 1

b. Pump 2

c. Pump 3

2. The load filter shall treat harmonics generated by fast insulated gate, bipolar gate transistors.

1.02 REFERENCES

A. 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. They shall be listed at the AIC ratings where installed on this project.

B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.

C. All materials and equipment specified herein, and their installation methods shall conform to the latest published version of the National Electric Code, NEC.

D. IEEE 519: IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

1.03 PERFORMANCE REQUIREMENTS

A. SEISMIC PERFORMANCE: Freestanding equipment or wall mounted equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. ENVIRONMENT

1. In a climate controlled, electrical/mechanical room.
2. Temperature from 32º to 104º Fahrenheit with 0 to 99% non-condensing relative humidity.
3. Altitude shall be above sea level to 500 feet above sea level.

C. UTILIZATION AND APPLICATION VOLTAGE

1. Three phase, 480 Volts, Wye service connected with 3 wires plus ground (delta), 60 Hertz.
2. One passive filter for each variable frequency drive.
3. One load filter for each variable frequency drive.

D. LOADING SCENARIOS

1. The will be 480
2. 5 kVA of linear load with one 200 hp, two 200 hp, or three 200 hp VFDs.
3. Each VFD will be 240A capacity, 6 pulse, 3% DC choke VFD.
4. The motors are projected to have the following loading:
    a. 190 A at each VFD usage operating with single motor
    b. 175 A at each VFD usage operating with two motors simultaneously
    c. 150 A at each VFD usage operating with three motors simultaneously

1.04 SUBMITTALS

A. Submittal documents shall conform to the requirements of Section 1-06, and Section 26 00 00 – Electrical General.

B. Submittals shall include the manufacturer’s name, address, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference. Include other information necessary to establish contract compliance of each item proposed to furnish.

C. Each item shall be clearly marked and provided with adequate sales and technical information to clearly show conformance with all aspects of the specification. Packages not provided as described above or largely incomplete shall be returned to the Contractor, without comment.

D. After review by the Engineer, the Contractor shall submit the Shop Drawings of the service section to the utility company for approval prior to fabrication.

1.05 COORDINATION OF EQUIPMENT

A. It is the Contractor's responsibility to coordinate equipment information with the transfer switch manufacturer so that the correct type of equipment is provided and sized properly for the devices being served and to supply such equipment with the proper protection.

B. The Contractor shall verify that all equipment will fit physically within the space allotted per the Drawings.

C. The Contractor shall be responsible to coordinate the features, controls, ratings, etc. of the transfer switch to match the requirements of the proposed generator.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Acceptable manufacturers are as follows:

1. TCI, LLC (Transcoil)
2. MTE Corporation
3. Or equal.

B. The equipment of the manufacturer selected must fit within the space restrictions as shown on the Drawings.

C. Although any of the named products are very similar and should not require significant modification of the design, the Contractor shall be responsible for all costs associated with alterations to accommodate other named manufacturers, or those attributed to a proposed alternate manufacturer that may have any combinations of different size, characteristics, or configuration. The transfer switches shall be as shown on the drawings.

2.02 PASSIVE HARMONIC FILTER

A. Provide an adaptive passive series connected low pass filter consisting of an inductor-capacitor network. Active electronic current injection systems are not acceptable.

1. An integrated series and shunt reactor shall be used in the construction of the harmonic filter.

2. The filter shall be supplied with a contactor to isolate the filter capacitance. The contactor shall operate from a maximum 120 VAC pilot circuit. The filter shall provide a 480-120 VAC control power transformer sized to operate the contactor. Control power transformer shall be protected by at least three fuses; two fuses shall protect the 480 VAC taps and at least one fuse shall protect the ungrounded 120 VAC tap.

3. The filter shall provide a thermostat or similar dry contact for monitoring of overtemperature of the filter.

B. The harmonic filter model supplied shall be capable of feeding a three-phase input rectifier with or without line reactors, with or without a DC link choke, with or without a combination line reactor and DC link choke. The harmonic filter model supplied shall be capable of feeding a rectifier composed of diodes, thyristors or any combination thereof.

1. The harmonic filter shall not resonate with the power distribution system nor attract harmonics from other sources.

2. The harmonic filter shall meet the harmonic performance specification with a three percent phase voltage unbalance as defined in ANSI C-84.1-1995.

C. To assure that the filter will not reduce the life of a voltage source inverter's bus capacitor, the output current waveform of the harmonic filter and the input current waveform of the inverter shall be consistent with the input waveform of an inverter fed from a drive equipped with a 3% minimum impedance line reactor.

2.03 ENCLOSURES

A. INDOOR ENCLOSURES: Freestanding steel cabinets unless otherwise indicated. NEMA 250, Type 1A unless otherwise indicated to comply with environmental conditions at installed location.

B. ENCLOSURE FINISH FOR INDOOR UNITS: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

PART 3 : EXECUTION

3.01 GENERAL

All assembly and wiring not completed by the manufacturer shall be the responsibility of the Contractor.

3.02 INSTALLATION

A. The equipment shall not be shipped to the site until a suitable environment is available for installation of the equipment. A suitable environment for the purposes of this contract shall be dry, covered and heated to maintain a minimum ambient temperature of 60 degrees F. Prior to shipment of electrical equipment, the Contractor shall contact the Engineer for field verification of a suitable environment.

B. The transfer switch shall be installed in accordance with the installation drawings and instructions. Installation shall be performed by workers who are skilled and experienced in the installation of motor control equipment. It is the Contractor's responsibility to provide sufficient space for the equipment and size of equipment to fit within the space requirements and meet all code requirements.

3.03 CONFIGURATION

A. Where indicated, the capacitor isolation contactor shall be interlocked with the associated VFD "Running" or "At-Speed indication" and the "ATS Connected to Normal" power position. Where the harmonic filter is associated with more than one ATS, if any ATS is not connected to normal power then the Contactor shall be disabled.

B. The Over-temperature thermostat shall disable the associated VFD or VFDs.

3.04 TESTING

A. Harmonic filters shall be configured by the Contractor and field tested along with the control system and the generator per the requirements in this section. Operation of all the automatic transfer switch functions shall be tested. The testing shall include, but not be limited to, operation of all input and output (I/O) points, control devices for a continuous period of 2 days.

B. Testing and inspection of the automatic transfer switch shall include all components.

C. After completion of initial testing, Contractor shall conduct subsequent testing for inspection by the Engineer. The Contractor shall provide for time, equipment and support for the Engineer to test the harmonic filter and automatic transfer switch for a period of up to 1 day. All control functions and all status and alarm monitoring and indication shall be demonstrated under simulated operating conditions.

END OF SECTION

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SECTION 26 36 13
MANUAL TRANSFER SWITCHES

PART 1 : GENERAL

1.01 DECRIPTION OF WORK

A. This section provides equipment and installation for load transfer manual transfer switches (MTS).

1. Provide one MTS, capable of simultaneously connecting 4 poles of load between two different sources of 480-volt, three phase electrical power as shown on the Drawings.

2. The MTS may incorporate closure solenoids. Non-automatic transfer switches or Automatic transfer switches are acceptable.

B. Provide indicating switches, nameplates, and controls as shown on the Drawings and specified herein.

1.02 REFERENCES

A. 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. They shall be listed at the AIC ratings where installed on this project.

B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.

C. All materials and equipment specified herein, and their installation methods shall conform to the latest published version of the National Electric Code (NEC).

1.03 SUBMITTALS

A. Submittal documents shall conform to the requirements of Section 1-06 – Control of Materials and Section 26 00 00 – Electrical General.

B. Submittals shall include the manufacturer’s name, address, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference. Include other information necessary to establish contract compliance of each item proposed to furnish.

C. Each item shall be clearly marked and provided with adequate sales and technical information to clearly show conformance with all aspects of the specification. Packages not provided as described above or largely incomplete shall be returned to the Contractor, without comment.

D. After review by the Engineer, the Contractor shall submit the Shop Drawings of the service section to the utility company for approval prior to fabrication.

1.04 COORDINATION OF EQUIPMENT

A. It is the Contractor's responsibility to coordinate equipment information with the transfer switch manufacturer so that the correct type of equipment is provided and sized properly for the devices being served and to supply such equipment with the proper protection.

B. The Contractor shall verify that all equipment will fit physically within the space allotted per the Drawings.

C. The Contractor shall be responsible to coordinate the features, controls, ratings, etc. of the transfer switch to match the requirements of the Owner's existing portable generator and existing generator to be relocated.

1.05 COORDINATION WITH CONTROL SYSTEM

A. The transfer switch manufacturer shall equip the assembly with all appurtenances and accessories (including but not limited to control relays, control contacts, control wiring and terminal strips) as required by the Control System Integrator for interface with the main control system and as required to interface with the generator to provide a totally integrated and operable system.

B. The Control System Integrator, as specified in Section 40 61 13 – Process Control System General Provisions, shall be responsible for coordination and integration of control system with the transfer switch controls.

C. The System Integrator shall direct the transfer switch supplier to provide all intended details of the equipment which may influence or affect the control system. The System Integrator shall determine all requirements for and shall cause integration of the control system and the pump starters into a unified operating system. The System Integrator will define all requirements for all interfacing equipment, appurtenances and accessories.

1.06 O&M DATA

Provide O&M data for all transfer switch and related equipment in accordance to the general requirements in Section 26 00 00 – Electrical General.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Acceptable manufacturers are as follows:

1. Schneider Electric (ASCO).
2. Cummins (Onan) Corporation.
3. Eaton Electrical (Cutler Hammer/Westinghouse).

B. The equipment of the manufacturer selected must fit within the space restrictions as shown on the Drawings.

C. The design shown on the drawings is based upon Eaton Electrical. Although named products are very similar and should not require significant modification of the design, the Contractor shall be responsible for all costs associated with alterations to accommodate other named manufacturers, or those attributed to a proposed alternate manufacturer that may have any combinations of different size, characteristics, or configuration. The transfer switches shall be as shown on the drawings.

D. The transfer switch shall be mechanically and electrically held and rated to 600 volts for all classes of load and continuous inductive duty.

E. The transfer switch shall conform to UL 1008 Revision 4 provisions for Withstand Current Ratings and Closing Ratings. The ATS shall be rated for a fault current of 42,000 amperes RMS symmetrical minimum, or as shown on the Drawings, whichever is the greater number.

F. The switch shall be capable of enduring 6,000 cycles of complete opening and closing at rated current and voltage at a rate of 6 cycles per minute without failure.

G. The switch shall be double throw inherently interlocked mechanically and electrically to prevent supplying the load from both sources simultaneously. The operating current shall be obtained from the source to which the load is to be transferred. The transfer mechanism shall be of the double break design with solid silver cadmium surface contacts and individual heat resistant arc chambers.

H. Single break contacts will also be acceptable if arc barriers and magnetic blow out coils are used. The contacts shall be capable of carrying 20 times the continuous rating for interrupting current.

I. All contacts, coils, etc. shall be readily accessible for replacement from front of panel without major disassembly of associated parts.

J. The transfer switch shall have UL 1008 label and listing.

K. Switch shall be suitable for outdoor installation with NEMA 3R enclosure.

2.02 CONTROLS HARDWARE

A. Provide auxiliary contacts for indicating manual transfer switch position; contact must close when the manual transfer switch is in the normal power position and open otherwise.

B. All relays shall be provided with indicating LED lights for energized position indication.

C. All wiring shall be numbered at each end with basic wiring numbering scheme.

D. All terminals shall be clearly labeled.

E. All internal equipment shall be labeled.

F. All external devices shall be clearly labeled.

PART 3 : EXECUTION

3.01 GENERAL

A. Transfer switches shall be assembled per the System Integrators and generator manufacturers requirements. The transfer switches shall be delivered to the site ready for external connections to field equipment. Transfer switch shall be leveled and securely anchored to the floor.

B. All assembly and wiring not completed by the manufacturer or Integrator, due to shipping sections, multiple suppliers, etc. shall be the responsibility of the Contractor.

C. Transfer switch shall be installed to meet IBC 2015 seismic requirements according to the manufacturer's recommendations.

3.02 INSTALLATION

A. The transfer switch equipment shall not be shipped to the site until a suitable environment is available for installation of the equipment. A suitable environment for the purposes of this contract for the automatic transfer switch shall be dry, covered and heated to maintain a minimum ambient temperature of 60 degrees F. Prior to shipment of electrical equipment, the Contractor shall contact the Engineer for field verification of a suitable environment.

B. The transfer switch shall be installed in accordance with the installation drawings and instructions. Installation shall be performed by workers who are skilled and experienced in the installation of motor control equipment. It is the Contractor's responsibility to provide sufficient space for the equipment and size of equipment to fit within the space requirements and meet all code requirements.

3.03 TESTING

A. Testing and inspection of the transfer switch shall include all components.

B. After completion of initial testing, Contractor shall conduct subsequent testing for inspection by the Engineer. The Contractor shall provide for time, equipment and support for the Engineer to test the automatic transfer switch for a period of up to 1 day. All control functions and all status and alarm monitoring and indication shall be demonstrated under simulated operating conditions.

END OF SECTION

SECTION 26 36 23
AUTOMATIC TRANSFER SWITCHES (ATS)

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section provides equipment and installation for automatic transfer switch (ATS).

1. Provide one ATS, capable of simultaneously connecting 3 poles of load between two different sources of ~~240 volt, single-phase (two phases and one neutral)~~ 208 volt, three-phase (three phases and one neutral)* electrical power as shown on the Drawings.

B. Automatic system load transfer switch shall be supplied as an integral component of the generator set and control system. Transfer switch shall be well documented with clear wiring diagrams and submittals shall include wiring diagram showing clearly all connections for field wiring with terminal numbering.

C. Provide indicating lights, switches, meters, nameplates, and controls as shown on the Drawings and specified herein.

1.02 REFERENCES

A. 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. They shall be listed at the AIC ratings where installed on this project.

B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.

C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C.

1.03 SUBMITTALS

A. Submittal documents shall conform to the requirements of Section 1-06 – Control of Materials and Section 26 00 00 – Electrical General.

B. Submittals shall include the manufacturer’s name, address, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference. Include other information necessary to establish contract compliance of each item proposed to furnish.

C. Each item shall be clearly marked and provided with adequate sales and technical information to clearly show conformance with all aspects of the specification. Packages not provided as described above or largely incomplete shall be returned to the Contractor, without comment.

D. After review by the Engineer, the Contractor shall submit the Shop Drawings of the service section to the utility company for approval prior to fabrication.

1.04 COORDINATION OF EQUIPMENT

A. It is the Contractor's responsibility to coordinate equipment information with the transfer switch manufacturer so that the correct type of equipment is provided and sized properly for the devices being served and to supply such equipment with the proper protection.

B. The Contractor shall verify that all equipment will fit physically within the space allotted per the Drawings. The Contractor shall be responsible to coordinate the features, controls, ratings, etc. of the transfer switch to match the requirements of the generator as described in Section 26 32 00 – Power Generation.

1.05 COORDINATION WITH CONTROL SYSTEM

A. The transfer switch manufacturer shall equip the assembly with all appurtenances and accessories (including but not limited to control relays, control contacts, control wiring and terminal strips) as required by the Control System Integrator for interface with the main control system and as required to interface with the generator to provide a totally integrated and operable system.

B. The Control System Integrator, as specified in Section 40 61 13 – Process Control System General Provisions, shall be responsible for coordination and integration of control system with the transfer switch controls.

C. The System Integrator shall direct the transfer switch supplier to provide all intended details of the equipment which may influence or affect the control system. The System Integrator shall determine all requirements for and shall cause integration of the control system and the pump starters into a unified operating system. The System Integrator will define all requirements for all interfacing equipment, appurtenances and accessories.

1.06 O&M DATA

Provide O&M data for all transfer switch and related equipment in accordance to the general requirements in Section 26 00 00 – Electrical General.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Acceptable manufacturers (automatic transfer switches) are as follows:

1. Cummins (Onan) Corporation.
2. Eaton Electrical (Cutler Hammer/Westinghouse).

B. The equipment of the manufacturer selected must fit within the space restrictions as shown on the Drawings.

C. The design shown on the drawings is based upon Eaton Electrical. Although either named products are very similar and should not require significant modification of the design, the Contractor shall be responsible for all costs associated with alterations to accommodate other named manufacturers, or those attributed to a proposed alternate manufacturer that may have any combinations of different size, characteristics, or configuration. The transfer switches shall be as shown on the drawings.

D. The transfer switch shall be mechanically and electrically held and rated to 600 volts for all classes of load and continuous inductive duty.

E. The transfer switch shall conform to UL 1008 Revision 4 provisions for Withstand Current Ratings and Closing Ratings. The ATS shall be rated for a fault current of 22,000 amperes RMS symmetrical minimum, or as shown on the Drawings, whichever is the greater number.

F. The switch shall be capable of enduring 6000 cycles of complete opening and closing at rated current and voltage at a rate of 6 cycles per minute without failure.

G. The automatic transfer switch shall be open transition, programmable delay type with a minimum adjustable pause-in-neutral (not connected to normal or standby) capability of 10 seconds, incorporating isolating switching unit mechanisms and overcurrent protection on the utility supply with number of poles as specified on the Drawings.

H. The switch shall be double throw inherently interlocked mechanically and electrically to prevent supplying the load from both sources simultaneously. The operating current shall be obtained from the source to which the load is to be transferred. The transfer mechanism shall be of the double break design with solid silver cadmium surface contacts and individual heat resistant arc chambers.

I. Single break contacts will also be acceptable if arc barriers and magnetic blow out coils are used. The contacts shall be capable of carrying 20 times the continuous rating for interrupting current.

J. All contacts, coils, etc. shall be readily accessible for replacement from front of panel without major disassembly of associated parts.

K. The transfer switch shall have UL 1008 label and listing.

2.02 CONTROLS HARDWARE

A. All relays shall be provided with indicating LED lights for energized position indication.

B. Time delay relays shall be provided with timing and timed out LED indicators.

C. Panel front Indication lights shall be push-to-test or the switch shall have a push to test feature for indication lights, unless lights are LED.

D. All fuses shall be provided with “blown fuse” indicators.

E. All wiring shall be numbered at each end with basic wiring numbering scheme.

F. All terminals shall be clearly labeled.

G. All internal equipment shall be labeled.

H. All external devices shall be clearly labeled.

I. Provide transfer switch with solid state logic control.

J. Automatic Transfer-Switch Programming Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value.
2. Adjustable Time Delay before starting the standby engine generator: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Pickup frequency shall be adjustable from 90 to 100 percent of nominal.
4. Commit to Transfer on Single Phase: The ATS will transfer to the standby power source when the utility fails on a single phase event for a period of time even if normal power appears to return after the load is disconnected from the normal power.
5. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, the continuous time for which the normal power source must be available before the switch attempts to reconnect to normal power.
    a. The time delay for Retransfer to Normal Source shall be bypassed if the emergency power source fails and the ATS shall connect to the neutral position.
6. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to at least 30 seconds. Time delay occurs for both transfer directions.
7. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes. Contacts shall allow shutdown at remote engine-generator controls after retransfer of load to normal source.
8. Engine-Generator Exerciser: Solid-state, programmable-time switch capable of starting engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Exerciser features include the following:
    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.

b. Push-button programming control with digital display of settings.

c. Integral battery operation of time switch when normal control power is not available.

K. AUTOMATIC TRANSFER-SWITCH FEATURES

1. Test Switch: Simulate normal-source failure.

2. Switch-Position Pilot Lights: Indicate source to which load is connected.

   a. Normal Power Connected: Green light with nameplate engraved "Normal Source Connected."

   b. Emergency Power Connected: Red light with nameplate engraved "Emergency Source Connected."

3. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

   b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

4. Auxiliary Contacts: Each shall be normally open, single-pole, double-throw contacts for each switch position, rated 10 Amperes at 240 Volts alternating current and 1 ampere at 24 volts direct current. At a minimum, provide the following signals:

   a. “In Normal Power Position”; Normally open contact shall close when ATS is connected to the normal power position and the contact shall be open otherwise.

   b. “In Standby Power Position”; Normally open contact shall close when ATS is connected to the normal power position and the contact shall be open otherwise.

   c. “Normal Power Available”; Normally open contact shall close when ATS senses normal power is available and the contact shall be open otherwise. In other words, if the normal power is not within the programmed tolerances of the ATS, the contact shall open.

5. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source.

6. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; minimum rating of 20 Amperes and 32 Volts direct current.

7. Network connection: Provide an Ethernet based interface to the transfer switch control system. The interface shall allow configuration of the ATS parameters using an integral-to-the-device web page through the network connection. The network connection shall also make available the per-phase voltages, the per phase amperage reading of the connected load and the position status of the ATS available via Rockwell Automation Ethernet/IP or Modicom Modbus TCP.

a. The network connection shall be compatible with Owners network equipment and shall use 10/100TX over copper communications cable, Cat-5e or better, using RJ45 style ports and plugs.

8. Generator battery connection for ATS system: Provide fused and normal terminals to power the ATS control system from engine generator starting voltage.

PART 3 : EXECUTION

3.01 GENERAL

A. Transfer switches shall be assembled per the System Integrators and generator manufacturers requirements. The transfer switches shall be delivered to the site ready for external connections to field equipment. Transfer switch shall be leveled and securely anchored to the floor.

B. All assembly and wiring not completed by the manufacturer or Integrator, due to shipping sections, multiple suppliers, etc. shall be the responsibility of the Contractor.

C. Transfer switch shall be installed to meet IBC 2015 seismic requirements according to the manufacturer's recommendations.

3.02 INSTALLATION

A. The transfer switch equipment shall not be shipped to the site until a suitable environment is available for installation of the equipment. A suitable environment for the purposes of this contract for the automatic transfer switch shall be dry, covered and heated to maintain a minimum ambient temperature of 60 degrees F. Prior to shipment of electrical equipment, the Contractor shall contact the Engineer for field verification of a suitable environment.

B. The transfer switch shall be installed in accordance with the installation drawings and instructions. Installation shall be performed by workers who are skilled and experienced in the installation of motor control equipment. It is the Contractor's responsibility to provide sufficient space for the equipment and size of equipment to fit within the space requirements and meet all code requirements.

3.03 AUTOMATIC TRANSFER SWITCH CONFIGURATION

A. AUTOMATIC TRANSFER SWITCH PROGRAMMING FEATURES

1. Under-voltage Sensing dropout shall be set to 85 percent of nominal voltage and pickup shall be set to 90 percent.

2. Adjustable time delay before starting the standby engine generator: Shall be set to 10 seconds.

3. Voltage/Frequency Lockout Relay: Pickup voltage shall be set to 90% of nominal. Pickup frequency shall be set to 95% of nominal frequency (57 hertz).

4. Commit to Transfer on Single Phase: Function shall be disabled unless a false voltage is observed during testing.

5. Time Delay for Retransfer to Normal Source: Timer shall be set to 10 minutes.

6. Programmed Neutral Switch Position: Shall be set to be not connected to either normal or standby source for 10 seconds.

7. Engine Shutdown Contacts: Time delay shall be set to 5 minutes after ATS is connected to normal power from standby power.

8. Engine-Generator Exerciser: Operate the engine generator unloaded for 20 minutes, once a week, at 7:30 AM on Tuesday morning. Provide a manual test button which, when pressed, will start and run the engine generator, transfer load to the standby source, and continue to run until the retransfer sequence is initiated (or the standby source stops).

3.04 TESTING

A. Automatic transfer switches shall be configured by the Contractor and field tested along with the control system and the generator per the requirements in this section and Section 40 61 13 – Process Control System General Provisions. Operation of all the automatic transfer switch functions shall be tested. The testing shall include, but not be limited to, operation of all input and output (I/O) points, control devices for a continuous period of 2 days.

B. Testing and inspection of the automatic transfer switch shall include all components.

C. After completion of initial testing, Contractor shall conduct subsequent testing for inspection by the Engineer. The Contractor shall provide for time, equipment and support for the Engineer to test the automatic transfer switch for a period of up to 1 day. All control functions and all status and alarm monitoring and indication shall be demonstrated under simulated operating conditions.

D. Provide a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain.

END OF SECTION

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SECTION 26 50 00
LIGHTING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This Section covers furnishing and installation of all light fixtures and lamps indicated on the drawings or specified herein.

1.02 STANDARDS AND CODES

A. 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.

B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.

C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C.

1.03 SUBMITTALS

Submit catalog data showing material information and conformance with Division 01 and Section 26 00 00 – Electrical General. The intended use of each item shall be indicated.

PART 2 : PRODUCTS

2.01 LIGHT FIXTURES

A. Fixture Schedule - Provide in accordance with Lighting Fixture Schedule at end of this Section or as shown on plans.

B. The fixture catalog numbers listed in the fixture schedule indicate manufacturer, fixture design, quality of design and manufacture, appearance, features and options required. Lighting fixtures specified will be the basis for comparison in the consideration of fixtures of other manufacturers. Fixtures of lesser quality shall not be considered equivalent.

C. Contractor shall investigate ceiling construction and supply fixtures designed for the application.

D. Contractor shall investigate possible interferences of equipment, hatches, overhead cranes, etc. and supply fixtures (size and profile) that will not interfere.

E. All fixture component parts shall be manufactured and/or assembled at the manufacturing plant for shipment. The shipment from the fixture manufacturer shall include integrally mounted and/or remote mounted ballasts where ballasts are required for the proper operation of the fixture lamps.

2.02 HARDWARE

The Contractor shall provide any necessary hardware for mounting fixtures. The mounting hardware shall be made of materials suitable for the environment installed. Provide materials made from aluminum, non-metallic, or stainless steel in outdoor, damp, or corrosive areas.

2.03 SPECIAL ACCESSORIES

Provide accessories such as junction boxes, plastic frames, stem, hangers, canopies, couplings, cords, toggle bolts, etc., necessary to mount fixture in a proper and approved method.

2.04 CONTROLS

A. Outdoor Lighting Controls

1. Provide a pilot illuminated snap switch which illuminates when fixture is powered. A photo-eye integral to the lighting fixture will energize the fixture when low ambient light levels are detected and power is available to the fixture.

B. Indoor Lighting Controls

1. Provide Snap switches where indicated to control luminaires.

a. Where indicated, provide dual detection method (i.e., infrared and motion) occupancy sensor with integral timer to shut off lights after room is unoccupied.

PART 3 : EXECUTION

3.01 RACEWAY & WIRE

For all lights, switches, and other related devices of the lighting system, provide all necessary raceway and wire per Division 26 – Electrical for a complete installation.

3.02 FIXTURE MOUNTING

A. The fixture supplier shall provide all necessary hanging or mounting devices for all fixtures and shall be responsible for checking the type needed for various ceiling conditions. Use the following methods unless noted otherwise:

1. For indoor mounting on flat ceilings at 10 feet above finished floor or below, surface mount to the ceiling.
2. For indoor mounting on sloped or pitched ceilings, provide suspension mounting kit and mount lights parallel to the floor. For each fixture, provide one of the following:

a. Steel channel supports (e.g., unistrut).

b. Chain hang and support kit.

c. Cable hang and support kit.

B. The Contractor shall see that all lighting fixtures designed to be installed throughout the project shall be of the correct size and design to properly suit the requirements of each area prior to ordering fixtures.

C. Contractor shall install fixtures to avoid access hatches, sky lights, rails, mechanical equipment, etc.

D. Any additional hardware needed for installation of fixtures shall be provided by the Contractor; including poles, clamps, brackets, screws, bolts, etc.

E. Fixtures and other equipment installed in hazardous areas shall be rated for the environment. Provide fittings and seals per NEC.

F. Where fixtures are indicated for installation on low-density ceiling material, mount on 1 1/2" ceiling spacers unless UL approved for mounting directly to ceiling material.

G. Properly support and align fixtures and provide all necessary steel shapes for support of the fixtures. Coordinate complete fixture installation with the facility construction. Clean and mount all lighting fixtures with new lamps immediately prior to final inspection.

H. Square and rectangular fixtures shall be mounted with sides parallel to building lines and parallel with ceiling lines.

END OF SECTION

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SECTION 31 10 00
SITE CLEARING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

This Section includes site clearing, grubbing and stripping, and removal of all trash, shrubs and debris, and other unsuitable material within limits of clearing.

1.02 REFERENCES

A. Clearing, grubbing, and stripping shall be in accordance with the provisions of Sections 2-01 and 2-02 of the Standard Specifications, and to requirements specified herein. In the event of conflicts, the more restrictive requirement shall apply.

1. Standard Specifications - 2020 WSDOT Standard Specifications for Road, Bridge, and Municipal Construction.

PART 2 : PRODUCTS

Not Used.

PART 3 : EXECUTION

3.01 PREPARATION

A. Protect existing trees and other vegetation to remain against damage:

1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
3. Provide temporary protection as required.

B. Repair or replace trees and vegetation not designated for removal that are damaged by construction operations:

1. Repairs to be performed by a qualified tree surgeon.
2. Remove trees that cannot be repaired and restored to full-growth status.
3. Replace with new trees of minimum 4 IN caliper.
4. Owner will obtain authority for removal and alteration work on adjoining property, if needed.

3.02 SITE CLEARING

A. TOPSOIL REMOVAL

1. Strip topsoil to depths encountered.
   a. Remove heavy growths of grass before stripping.

b. Stop topsoil stripping sufficient distance from trees not designated for removal to prevent damage to main root system.

c. Separate from underlying subsoil or objectionable material.

2. Stockpile topsoil for subsequent reuse.

a. Construct storage piles to freely drain surface water.

b. Seed or cover storage piles to prevent erosion.

B. CLEARING AND GRUBBING

1. Clear from within limits of clearing all trees not marked to remain:

a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, structures, and debris.

2. Grub (remove) from within limits of clearing all stumps, roots, root mats, logs and debris encountered:

a. Totally grub under areas to be paved.

b. Grubbing in lawn areas:

1) In cut areas, totally grub.

2) In fill areas, where fill is less than 3 FT, totally grub ground.

3) Where fill is 3 FT or more in depth, stumps may be left no higher than 6 IN above existing ground surface.

3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated. Place fill material in horizontal layers not to exceed six (6) inches loose depth, and thoroughly compact to a density equal to adjacent original ground.

C. DISPOSAL OF WASTE MATERIALS

1. Do not burn combustible materials on site.

2. Remove all waste materials from site and dispose of at an appropriate refuse facility.

3. Remove all vegetative waste from the site and transport to an appropriate composting facility.

4. Do not bury organic matter on site.

3.03 ACCEPTANCE

Upon completion of the site clearing, obtain the Engineer's acceptance of the extent of clearing, depth of stripping, and rough grade.

END OF SECTION

SECTION 31 23 33
TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Excavation, trenching, backfilling, and compacting for all underground utilities.
2. Excavation of earthwork of whatever consistency encountered.
3. Over-excavation of materials as directed by the Engineer.
4. Handling of excavated materials and associated cleanup.
5. Providing and placing various fill materials in accordance with the Contract Documents.
6. Compacting existing and imported materials suitable for the contemplated loadings.

1.02 STANDARDS AND CODES

A. ASTM International (ASTM):

1. C33, Standard Specification for Concrete Aggregates.
2. C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
4. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
5. D1241, Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses, with Gradation Requirements modified per this Specification.
6. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
7. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
8. D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
9. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
10. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

B. Standard Specifications for Road, Bridge, and Municipal Construction, 2020 by the Washington State Department of Transportation.

C. Reference Document: Geotechnical Engineering Technical Memorandum, Silverdale Pump Station 19 Upgrades, October 14, 2020, Landau Associates.

D. Reference Document: Geotechnical Engineering Technical Memorandum, Silverdale Pump Station 31 Upgrades, October 14, 2020, Landau Associates.

1.03 QUALITY ASSURANCE

Registered professional engineer licensed in the State of Washington for design of shoring systems or other excavation safety plans in accordance with Section 31 41 00 – Excavation Support Systems.

1.04 DEFINITIONS

EXCAVATION: all excavation will be defined as unclassified.

1.05 SUBMITTALS

A. Submit in accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions.

B. Product technical data including:

1. Acknowledgement that products submitted meet requirements of standards referenced.
2. Manufacturer's installation instructions.

C. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.

D. Mix design for controlled density fill (CDF).

E. TEST REPORTS

1. Submit sieve analysis reports on all granular materials in accordance with ASTM C136.
2. Submit maximum laboratory density test data (maximum modified proctor) in accordance with ASTM D1557 on all materials subject to compaction testing.
3. If the source or quality of any materials changes during construction, the Contractor shall furnish additional test reports to the Owner for review and acceptance prior to the use of the different material.

F. Informational submittals for Excavation Support Systems: see Section 31 41 00 – Excavation Support Systems.

G. See Section 31 23 43 – Earthwork for Dewatering Plan requirements.

1.06 PROJECT CONDITIONS

A. Avoid overloading or surcharging a sufficient distance back from edge of excavation to prevent slides or caving:

1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks, and other points as designated by the Owner to prevent serious interruption of travel.

C. Protect and maintain benchmarks, monuments, or other established points and reference points; and if disturbed or destroyed, replace items in accordance with WAC 332-120 to full satisfaction of the Owner and controlling agency.

D. Verify location of existing underground utilities.

PART 2 : PRODUCTS

2.01 MATERIALS

A. TRENCH BACKFILL

1. Bank Run Gravel for Trench Backfill: in accordance with Section 9-03.19 of the Standard Specifications. During wet weather construction, the amount of fines (material passing a U.S. No. 200 sieve) shall not exceed 5 percent by dry weight, based on a wet sieve analysis of that portion passing the ¾-inch sieve.

B. PIPE ZONE BEDDING

1. Gravel Backfill for Pipe Zone Bedding: in accordance with Section 9-03.12(3) of the Standard Specifications. During wet weather construction, the amount of fines (material passing a U.S. No. 200 sieve) shall not exceed 5 percent by dry weight, based on a wet sieve analysis of that portion passing the ¾-inch sieve.

C. FOUNDATION MATERIAL (GRAVEL BACKFILL FOR FOUNDATION)

1. Foundation Material, Class B: in accordance with Section 9-03.17 of the Standard Specifications if unsuitable materials are encountered.

D. Controlled Density Fill (CDF) shall be in accordance with Standard Specification Section 2-09.3(1)E.

PART 3 : EXECUTION

3.01 GENERAL

Remove and dispose of unsuitable materials from the site.

3.02 EXCAVATION

A. Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone, as shown on the Drawings or as directed by the Engineer.

B. EXCAVATION FOR APPURTENANCES

1. 12 IN (minimum) clear distance between outer surface and embankment.
2. See Specification Section 31 23 43 – Earthwork for applicable requirements.

C. Groundwater dewatering shall conform to Section 31 23 43 – Earthwork.

D. TRENCH EXCAVATION

1. Excavate trenches to depth shown on the Drawings and as necessary to accommodate work.
2. Support existing utility lines where proposed work crosses at a lower elevation.
3. Stabilize excavation to prevent undermining of existing utility.
4. Open trench outside buildings, units, and structures:
    a. No more than the distance between two manholes, structures, units, or 300 LF, whichever is less.
    b. Field adjust limitations as weather conditions dictate.
    c. All trenches shall be backfilled or covered with sheeting prior to the end of each day's work.
5. Trenching within buildings, units, or structures:
    a. No more than 100 LF at any one time.
6. Observe the following trenching criteria:
    a. Excavate width to accommodate free working space.
    b. Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the dimensions shown on the Drawings.
    c. Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service at a minimum.
    d. Keep trenches free of surface water runoff.

E. TRENCHING FOR ELECTRICAL INSTALLATIONS

1. Observe the preceding Trench Excavation paragraph in PART 3 of this Section.
2. Modify for electrical installations as follows:
    a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.

b. Any length of trench may be opened in exterior locations for trenches that are 12 IN wide or less.

c. Do not over excavate trench without prior approval by the Engineer.

d. Cut trenches for electrical runs with a minimum 30 IN cover, unless otherwise specified or shown on the Drawings.

e. See Division 26 – Electrical for additional requirements.

F. FLOWABLE FILL OR CDF

1. CDF shall be:

a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.

b. Placed in 4 FT maximum lifts to the elevations indicated:

1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.

2) Contractor shall place CDF lifts in such a manner as to prevent flotation of the pipe.

2. CDF shall not be placed on frozen ground.

3. Subgrade on which CDF is placed shall be free of disturbed or softened material and water.

4. Conform to appropriate requirements of Section 31 23 43 – Earthwork.

5. CDF batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DegF and rising.

6. At the time of placement, CDF shall have a temperature of at least 40 DegF.

7. Mixing and placing shall stop when the air temperature is 38 DegF or less and falling.

8. Each filling stage shall be as continuous an operation as is practicable.

9. Contractor shall prevent traffic contact with CDF for at least 24 HRS after placement or until CDF is hard enough to prevent rutting by construction equipment.

10. CDF shall not be placed until water has been controlled or groundwater level has been lowered in accordance with the requirements of groundwater dewatering in Section 31 23 43 – Earthwork.

3.03 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. OVER-EXCAVATION

1. If unsuitable foundation material is encountered, it shall be overexcavated, backfilled as specified and compacted to 90 percent of maximum dry density per ASTM D1557.

B. ROCK EXCAVATION

1. Excavate a minimum of 6 IN below bottom exterior surface of the pipe or conduit.
2. Form bell holes in trench bottom.

3.04 BACKFILLING METHODS

A. Carefully compacted Trench Backfill and Pipe Zone Bedding materials. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit:

1. Comply with the following:
   a. Place backfill in lifts not exceeding 6 IN (compacted thickness).
   b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill around the haunches of the pipe.
   c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
   d. Compact each lift to specified requirements.

B. TRENCH BACKFILL

1. Perform in accordance with the following:
   a. Place backfill in lift thicknesses capable of being compacted to densities specified. Maximum lift thickness shall be 12 IN (compacted thickness) provided Contractor sufficiently demonstrates his means and methods are capable of obtaining the required compaction. Otherwise, maximum lift thickness shall be 6 IN (compacted thickness) at the discretion of the Engineer.
   b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
   c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.
   d. Legally dispose of all excavated material that is not reused as backfill.

C. BACKFILL AT UTILITY CROSSINGS

1. When a new utility crosses under an existing utility, backfill at least the final 12-inches of trench beneath the invert of the existing utility with CDF to provide a uniform bedding for the existing utility.
2. Provide forms to control quantity of CDF that is used as backfill. Remove forms after CDF has set sufficiently to stand on its own without the forms.
3. Allow CDF to set sufficiently to support the weight and compaction efforts of the remaining backfill placing and compacting the remaining backfill material.

D. Water flushing for consolidation is not permitted.

E. BACKFILLING FOR ELECTRICAL INSTALLATIONS

1. Observe the preceding Carefully Compacted Backfill paragraph or Trench Backfill paragraph in PART 3 of this Section or when approved by the Engineer.

2. Modify for electrical installation as follows:

a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.05 COMPACTION

A. GENERAL

1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.

2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. COMPACTION REQUIREMENTS

1. Unless noted otherwise on the Drawings or more stringently by other Specification sections, comply with following minimum trench compaction criteria:

a. Pipe Zone Bedding:

Location	Compaction Density
All locations	90 percent of maximum dry density by ASTM D1557

b. Trench Backfill:

Location	Compaction Density
Under pavements, roadways, surfaces, structures, sidewalks within highway right-of-ways	95 percent of maximum dry density by ASTM D1557
Under turfed, sodded, plant seeded, nontraffic areas	90 percent of maximum dry density by ASTM D1557

3.06 FIELD QUALITY CONTROL

A. TESTING: The Owner has retained a testing laboratory to perform the soils testing. The Contractor shall:

1. Assure that the Owner has immediate access for testing of all soils related work.

2. Ensure excavations are safe for testing personnel.

3. Pay for all costs associated with retesting associated with "Failing" tests.

END OF SECTION

SECTION 31 23 43
EARTHWORK

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Structure excavation and backfilling necessary for the construction of all structures associated with the project, except linear utility trenching, which is addressed in Section 31 23 33 – Trenching, Backfilling, and Compacting for Utilities.
2. Excavation of earthwork of whatever consistency encountered.
3. Over-excavation of materials, as directed by the Engineer.
4. Handling of excavated materials and associated cleanup.
5. Providing and placing various fill materials in accordance with the Contract Documents.
6. Compacting existing and imported materials suitable for the anticipated loadings.
7. Foundation requirements for roadways, Pump Station 19 access road areas, and other asphalt-surfaced areas are addressed in Section 32 12 16 – Hot Mix Asphalt (HMA) Paving.

1.02 STANDARDS AND CODES

A. ASTM International (ASTM):

1. C33, Standard Specification for Concrete Aggregates.
2. C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
4. D1241, Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses, with Gradation Requirements modified per this Specification.
5. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
6. D3786, Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.
7. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
8. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

9. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

10. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. Standard Specifications for Road, Bridge, and Municipal Construction, 2020 by the Washington State Department of Transportation.

C. Reference Document: Geotechnical Engineering Technical Memorandum, Silverdale Pump Station 19 Upgrades, October 14, 2020, Landau Associates.

D. Reference Document: Geotechnical Engineering Technical Memorandum, Silverdale Pump Station 31 Upgrades, October 14, 2020, Landau Associates.

1.03 QUALITY ASSURANCE

Registered professional engineer licensed in the State of Washington for design of shoring systems or other excavation safety plans in accordance with Section 31 41 00 – Excavation Support Systems.

1.04 DEFINITIONS

EXCAVATION: All excavation will be defined as unclassified.

1.05 SUBMITTALS

A. Submit in accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions.

B. Product technical data including:

1. Acknowledgement that products submitted meet requirements of standards referenced.

2. Manufacturer's installation instructions.

C. Certifications.

D. TEST REPORTS

1. Sieve analysis for all borrow materials in accordance with ASTM C136.

2. Laboratory density test data (maximum modified proctor) in accordance with ASTM D1557 on all materials subject to compaction testing.

3. Material source data.

4. If the source or quality of any materials changes during construction, the Contractor shall furnish additional test reports to the Owner for review and acceptance prior to the use of the different material.

E. At least 20 Working Days before dewatering is started, the Contractor shall submit a Construction Dewatering Plan to the Engineer. The Dewatering Plan shall include:

1. Details regarding method, installation, and construction of the dewatering system including:
    a. Numbers and types of equipment.
    b. Soil permeability.
    c. Anticipated and potential effects on adjacent structures and properties.
    d. Depth, locations, and conveyance capacity of equipment.
    e. Water discharge locations.
    f. Necessary permits and requirements for water discharge.
    g. An estimate of advance time to dewater the excavation prior to work in the excavation when necessary.
    h. Such other information to verify acceptable control and performance.
2. The Construction Dewatering Plan shall be prepared by a registered professional hydrogeologist or engineer licensed in the State of Washington; and shall be reviewed by the Engineer before the Contractor begins excavation.

PART 2 : PRODUCTS

2.01 MATERIALS

A. STRUCTURAL BACKFILL

1. As indicated on the Drawings.
    a. Select Borrow: in accordance with Section 9-03.14(2) of the Standard Specifications. During wet weather construction, the amount of fines (material passing a U.S. No. 200 sieve) shall not exceed 5 percent by dry weight, based on a wet sieve analysis of that portion passing the ¾-inch sieve.

B. FOUNDATION MATERIAL

1. As indicated on the Drawings.
    a. Foundation Material Class A: in accordance with Section 9-03.17 of the Standard Specifications.

C. CRUSHED SURFACING BASE COURSE (CSBC): in accordance with Section 9-03.9(3) of the Standard Specifications.

D. CRUSHED SURFACING TOP COURSE (CSTC): in accordance with Section 9-03.9(3) of the Standard Specifications.

E. GEOTEXTILE FILTER FABRIC

1. Nonwoven type.
2. Equivalent opening size: 50-100 (U.S. Standard Sieve).

3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.
4. Grab strength: 90 LBS minimum in either direction in accordance with ASTM D4632 requirements.
5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.

PART 3 : EXECUTION

3.01 PROTECTION

A. Protect existing surface and subsurface features on-site and adjacent to site as follows:

1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
2. Protect and maintain bench marks, monuments, or other established reference points and property corners:
    a. If disturbed or destroyed, replace in accordance with WAC 332-120: Survey Monuments-Removal or Destruction, at own expense to full satisfaction of Owner and controlling agency.
3. Verify location of utilities:
    a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
    b. Secure and examine local utility records for location data.
    c. Take necessary precautions to protect existing utilities from damage due to any construction activity. Service lines from the main utility may not be shown on the Drawings. The Contractor shall anticipate the need to work around these service lines.
    d. Repair damages to utility items at own expense.
    e. In case of damage, notify the Engineer and affected utility company at once so that required protective measures may be taken.
4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed:
    a. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
    b. All repairs to be made and paid for by the Contractor.
5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks, and other points as designated by the Owner to prevent interruption of travel.
6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

B. Salvageable items: carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.

C. Dispose of waste materials, legally, off site:

1. Burning, as a means of waste disposal, is not permitted.

3.02 SITE EXCAVATION AND GRADING

A. The work includes all operations in connection with excavation, borrow, construction of fills and embankments, rough grading, and disposal of excess materials in connection with the preparation of the site(s) for construction of the proposed facilities.

B. EXCAVATION AND GRADING

1. Perform as required by the Drawings.
2. Drawings may indicate both existing grade and finished grade required for construction of the Project:
    a. Stake all units, structures, piping, roads, parking areas, and walks and establish their elevations.
    b. Perform other layout work required.
    c. Replace property corner markers to original location if disturbed or destroyed.
3. Preparation of ground surface for embankments or fills:
    a. Before fill is started, scarify to a minimum depth of 6 IN in all proposed embankment and fill areas.
    b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
4. Protection of finish grade:
    a. During construction, shape and drain embankment and excavations.
    b. Maintain ditches and drains to provide drainage at all times.
    c. Protect graded areas against action of elements prior to acceptance of work.
    d. Reestablish grade where settlement or erosion occurs.

C. BORROW

1. Provide necessary amount of approved fill compacted to density at least equal to that indicated in this Section.
2. Include cost of all borrow material in original proposal.
3. Fill material to be approved by the Engineer prior to placement.

D. Construct embankments and fills as required by the Drawings:

1. Construct embankments and fills at locations and to lines of grade indicated:
    a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN:
    a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.
    b. Do not place material in layers greater than 8 IN loose thickness.
    c. Place layers horizontally and compact each layer prior to placing additional fill.
3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density:
    a. Control moisture for each layer necessary to meet requirements of compaction.

3.03 USE OF EXPLOSIVES

Blasting with any type of explosive is prohibited.

3.04 FIELD QUALITY CONTROL

A. The Owner will retain a qualified independent testing laboratory to perform the laboratory and field tests.

B. Do not include in bid price the cost of inspection services indicated herein as being performed by the independent testing laboratory.

C. Moisture density relations, to be established by the independent testing laboratory, are required for all materials to be compacted.

D. Extent of compaction testing will be as necessary to assure compliance with the Specifications.

E. Give a minimum of 24 HR advance notice to the Engineer when ready for compaction or subgrade testing and inspection.

F. Should any compaction density test or subgrade inspection fail to meet specified requirements, perform corrective work as necessary.

G. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.

3.05 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from the Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system necessary to successfully complete excavation, compaction, and construction requirements.

C. Remove frozen, loose, wet, or soft material; and replace with approved material as directed by the Engineer.

D. Stabilize subgrade with well-graded granular materials as directed by the Engineer.

E. Assure, by results of testing, that compaction densities comply with the following requirements:

1. Sitework:

Location	Compaction Density
Under Paved Areas, Sidewalks, and Piping	95 percent per ASTM D1557
Unpaved Areas	90 percent per ASTM D1557

2. Structures:

Location	Compaction Density
Inside of structures under foundations, under equipment support pads, under slabs-on-grade, and scarified existing subgrade under fill material	95 percent per ASTM D1557
Outside structures next to walls, piers, columns, and any other structure exterior member	90 percent per ASTM D1557

3. Specific areas:

Location	Compaction Density
Outside structures under equipment support foundations	95 percent per ASTM D1557

3.06 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. GENERAL

1. In general, work includes, but is not limited to, excavation for structures and retaining wall, removal of underground obstructions and undesirable material, furnishing and placing fill and backfill, and compaction of subgrade and backfill.

2. Obtain fill and backfill material necessary to produce grades required:
    a. Materials and source to be approved by the Engineer.
3. In this Section, the word "foundations" includes footings, base slabs, foundation walls, mat foundations, grade beams, piers, and any other support placed directly on soil.
4. In the paragraphs of this Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation requirements for structures:

1. General:
    a. Do not commence excavation for foundations for structures until the Engineer approves:
        1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
        2) Density and moisture content of site area compacted fill material meets requirements of the Specifications.
        3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
        4) Surcharge or mass fill material has been removed from construction area or portions thereof.
    b. Engineer grants approval to begin excavations.
2. Dimensions:
    a. Excavate to elevations and dimensions indicated or specified.
    b. Allow additional space as required for construction operations and inspection of foundations.
3. Removal of obstructions and undesirable materials in excavation includes, but is not limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Drawings:
    a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by the Engineer.
4. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill:
    a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
    b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, compact existing subgrade to density stated in this Section before fill material is placed thereon.
    c. Do not carry excavations lower than shown for foundations except as directed by the Engineer.

d. If any part of excavations is carried below required depth without authorization, maintain the excavation and start the foundation from the excavated level with concrete of the same strength as required for the superimposed foundation; no extra compensation will be made to the Contractor therefore.

5. Make excavations large enough for working space, forms, dampproofing, waterproofing, and inspection.

6. Notify the Engineer as soon as excavation is completed in order that subgrades may be inspected:

   a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and under retaining wall footings have been inspected and approved by the Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.

   b. Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.

   c. Place fill material, foundations, retaining wall footing, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.

   d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.

7. Dewatering:

   a. Refer to Geotechnical Engineering Report for Construction Dewatering considerations and on-site soils information.

   b. The Contractor is fully responsible for controlling groundwater.

   c. Excavations shall be kept free of water as necessary to advance the project and maintain safe working conditions.

   d. The Contractor shall control surface run-off to prevent entry or collection of water in excavations.

   e. The control of groundwater shall prevent softening of the bottom of excavations, or formations of “quick” or heaving conditions, or “boils”.

   f. Dewatering systems shall be designed and operated to prevent any removal or flowing of native soils or previously placed fill soils.

   g. In the event the subgrade is compromised as a result of the Contractor’s dewatering methods, the Contractor shall be fully responsible for restoring the integrity of the subgrade to the satisfaction of the Engineer.

h. Disposal of the water shall not cause injury to public or private property, or nuisance to the public, or degradation of the natural or built environment.

i. Sufficient pumping and power equipment in good working condition shall be available at all times for all emergencies, including power outage, and competent personnel shall be available at all times for the operation of the dewatering system.

j. Water discharge locations shall comply with required permits from Kitsap County, other local jurisdictions, State, and Federal agencies, as appropriate.

k. The Contractor shall discharge dewatering water in accordance with the terms of the Construction Stormwater General Permit and any other applicable project permits. No sediment shall present in the discharge water and the discharge volume/rate shall be within the permit's allowable capacity. All sediment removal measures shall be at the Contractor's expense.

l. If sediment-laden water is being discharged, the Contractor shall immediately cease dewatering discharge upon notification by the Owner or Engineer. The Contractor shall anticipate that the dewatering discharge may have to be discontinued for a period of time, especially during wet weather conditions. No claim may be made if the conditions require that the dewatering discharge be temporarily discontinued.

m. The Contractor shall do whatever is necessary to eliminate or minimize sediment transport during dewatering operations. If sediments or solids are present in the dewatering water, the Contractor shall employ best management practices (BMPs) to remove settleable and suspended solids as required to meet permit or water quality requirements.

n. The dewatering system shall be designed to prevent loss of foundation support to adjacent structure, underground installation, improvement, or the sides of an excavation. The dewatering system shall be installed and operated so that the groundwater level outside the excavation is not drawn down to the extent that would damage or endanger adjacent structure, underground installation, sidewalk, pavement, other improvement, or property.

o. The groundwater table shall be lowered to a minimum of 2 feet below the bottom of any excavation.

p. The return of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils and supported soils, prevent disturbance of compacted bedding and backfill, and prevent flotation or movement of structures and utilities.

q. Costs associated with dewatering excavations and controlling groundwater will be paid under bid item "Dewatering" in accordance with Section 1-09.2(7) of the WSDOT Division 1 Special Provisions.

r. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.

8. Subgrade stabilization:

   a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved Foundation Material as directed by the Engineer.

   b. Provide compaction density of replacement material as stated in this Section.

   c. Method of stabilization shall be performed as directed by the Engineer.

   d. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Engineer.

9. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and the Contractor receives approval to commence slab construction.

   a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 DegF until structure is completed and heated to a temperature of at least 50 DegF.

10. Protection of structures:

    a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.

    b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.

11. Shoring:

    a. Provide Excavation Support Systems in accordance with Section 31 41 00 – Excavation Support Systems.

    b. Shore, sheet pile, slope, or brace excavations as required to prevent them from collapsing.

    c. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.

12. Drainage:

    a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.

    b. Maintain excavations free of water where foundations, floor slabs, equipment support pads, or fill material are to be placed.

c. Provide pumping required to keep excavated spaces clear of water during construction.

d. Should any water be encountered in the excavation, notify the Engineer.

e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.

13. Frost protection:

a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.

b. When freezing temperatures are expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.

c. Protect excavation from frost if placing of concrete or fill is delayed.

d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.

e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 DegF.

C. Fill and backfill inside of structure and below foundations, base slabs, floor slabs, equipment support pads, and piping:

1. General:

a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by the Engineer and compacted to density specified herein.

b. Surface may be stepped by at not more than 12 IN per step or may be sloped at not more than 2 percent.

c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by the Engineer as being free of undesirable material and compacted to specified density.

2. Obtain approval of fill and backfill material and source from Engineer prior to placing the material.

3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.

4. Fill and backfill placement:

a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from the Engineer.

b. Place fill and backfill material in 6 IN maximum compacted thickness lifts as necessary to obtain required compaction density. 12 IN compacted thickness lifts may be used if the Contractor proves the required compaction density is being obtained.

c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.

d. Use hand operated equipment for filling and backfilling next to walls.

e. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.

f. Use vibratory equipment to compact granular material; do not use water.

5. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content, outside the exterior limits of foundations located around perimeter of structure as shown on the Drawings or the following horizontal distance whichever is greater:

a. As required to provide fill material to indicated finished grade.

b. 5 FT.

c. Distance equal to depth of compacted fill below bottom of foundations.

d. As directed by the Engineer.

D. Filling and backfilling outside of structures.

1. This paragraph of this Section applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.

2. Provide material as approved by the Engineer for filling and backfilling outside of structures.

3. Fill and backfill placement:

a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from the Construction Manager or Engineer.

b. Place fill and backfill material in 6 IN compacted thickness lifts as necessary to obtain required compaction density. 12 IN compacted thickness lifts may be used if the Contractor proves the required compaction density is being obtained.

c. Compact material with equipment of proper type and size to obtain density specified.

d. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.

e. Do not place fill or backfill material when the temperature is less than 40 DegF and when subgrade to receive material is frozen, wet, loose, or soft.

f. Use vibratory equipment for compacting granular material; do not use water.

4. Backfilling against walls:

a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.

b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.

c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.

d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.

E. Backfilling outside of structures under piping or paving:

1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Section.

2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.

3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Sections for the Project.

END OF SECTION

SECTION 31 25 14
SOIL EROSION AND SEDIMENT CONTROL

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Soil erosion and sediment control.

1.02 STANDARDS AND CODES

A. EROSION CONTROL STANDARDS: Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas by the United Sates Department of Agriculture (USDA), Soil Conservation Service, College Park, Maryland.

B. Standard Specifications for Road, Bridge, and Municipal Construction, 2020 by the Washington State Department of Transportation.

1.03 QUALITY ASSURANCE

Designate and have a Certified Erosion and Sediment Control Lead (CESCL) onsite at all times.

PART 2 : PRODUCTS

2.01 MATERIALS

A. Straw bales, twine tied.

B. PIPE RISER AND BARREL: 16 GA corrugated metal pipe (CMP) of size indicated.

C. STONE FOR STONE FILTER: 2 IN graded gravel or crushed stone.

D. GRASS SEED: Annual ryegrass.

E. FILTER FABRIC FENCE: Conform to Section 8-01.3(9)A2 of the Standard Specifications.

F. CATCH BASIN INSERTS: Conform to Section 8-01.3(9)D of the Standard Specifications. Inserts shall have straps to facilitate removal and cleaning of inserts and shall have a minimum storage capacity of 0.5 cf. Above inlet covers and inlet grate covers are not allowed.

G. CHECK DAMS: Conform to Section 8-01.3(6) of the Standard Specifications.

H. COIR LOGS: Conform to Section 8-01.3(6)A of the Standard Specifications.

I. Mulch shall be wood cellulose fiber with guar gum or accepted equal as a soil binder.

PART 3 : EXECUTION

3.01 PREPARATION

A. Prior to general stripping of topsoil and excavating:

1. Install perimeter filter fabric fence, as shown on the Drawings.
2. Excavate and shape sediment basins and traps.
3. Construct pipe spillways and install stone filter, if required.
4. Machine compact all berms, dikes and embankments for basins and traps.
5. Install straw bales where required:
    a. Provide two stakes per bale.
    b. First stake angled toward previously installed bale to keep ends tight against each other.
6. Install catch basin inserts, filter fabric fence, coir logs, and other erosion control measures, as necessary.

B. Construct sediment traps, where indicated on Drawings or as needed, during rough grading as grading progresses.

C. Temporarily seed slopes and topsoil stockpiles:

1. Rate: 1/2 LB/1000 SF.
2. Re-seed as required until good stand of grass is achieved.

D. Temporary erosion and sedimentation control measures shall be in place and functional before land disturbing activities take place.

3.02 DURING CONSTRUCTION PERIOD

A. Maintain erosion and sedimentation control measures:

1. Inspect regularly especially after rainstorms.
2. Repair, augment, or replace damaged or missing items.

B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.

C. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.

D. Do not disturb existing vegetation (grass and trees):

1. The Contractor shall over-seed areas at a rate of 5 pounds per 1,000 square feet where the Contractor's actions have compromised the erosion and sedimentation control functions of the existing vegetation.

2. Areas subsequently disturbed by the Contractor's operations shall be reseeded.

E. Remove sediment out of basins, traps, and catch basin inserts, when capacity has been reduced by 50 percent.

F. Remove sediment from behind bales to prevent overtopping.

G. Topsoil and fine grade slopes and swales, etc.: Seed and mulch as soon as areas become ready. Apply mulch at 200 pounds per acre minimum.

H. All construction areas shall be properly protected and stabilized with erosion and sedimentation control measures as construction progresses.

3.03 NEAR COMPLETION OF CONSTRUCTION

A. Remove basins, dikes, traps, etc.

B. Grade to finished or existing grades.

C. Fine grade all remaining earth areas, then seed and mulch.

D. Clean catch basins and stormwater conveyance piping.

END OF SECTION

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SECTION 31 41 00
EXCAVATION SUPPORT SYSTEMS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

Work covered in this Section includes requirements for cribbing and shoring to be used for demolition, structural excavations, and trench safety.

1.02 SUBMITTALS

A. Submit in accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions.

B. Submit the following:

1. Certification that all excavation support system design work has been performed under the direction of a professional engineer licensed by the State of Washington.
2. Structural shoring design and support calculations for all shoring system that will be used for this project. The shoring design shall be stamped by a professional engineer licensed in the State of Washington. Watertight shoring may be required for deeper excavations.
3. Shoring contractor qualifications.

C. INFORMATIONAL SUBMITTALS

1. Trench shield (trench box) certification, if employed:
   a. Specific to Project conditions.
   b. Re-certified if members become distressed.
   c. Certification by registered professional structural engineer, registered in the State of Washington.
   d. Engineer is not responsible to, and will not, review and approve.
2. Watertight shoring plan and certifications, if employed:
   a. Specific to Project conditions.
   b. Re-certified if members become distressed.
   c. Certification by registered professional structural engineer, registered in the State of Washington.
   d. Engineer is not responsible to, and will not, review and approve.
3. Trench safety plan and/or trench shoring drawing:
   a. Trench Safety Plan and/or trench shoring drawings submittal is required only as evidence that plans and drawings have been prepared if required by authorities having jurisdiction.
   b. Engineer is not responsible to, and will not, review and approve.

1.03 STANDARDS AND CODES

A. WAC 296-155 – Safety Standards for Construction Work.

B. RCW Chapter 39.04.180 – Public Works/Trench Excavations – Safety Systems Required.

C. RCW Chapter 49.17 Washington Industrial Safety and Health Act.

D. Standard Specifications for Road, Bridge, and Municipal Construction, 2020 by the Washington State Department of Transportation.

E. Reference Document: Geotechnical Engineering Technical Memorandum, Silverdale Pump Station 19 Upgrades, October 14, 2020, Landau Associates.

F. Reference Document: Geotechnical Engineering Technical Memorandum, Silverdale Pump Station 31 Upgrades, October 14, 2020, Landau Associates.

1.04 QUALITY ASSURANCE

A. The shoring contractor shall:

1. Specialize in earth retention/construction as its primary business.
2. Be fully experienced and properly qualified, licensed, equipped, organized and financed to perform the shoring and excavation support work.
3. Have successfully completed at least five projects of similar scope and shoring/earth retention requirements in similar soil and groundwater conditions in the last five (5) years.

1.05 SYSTEM REQUIREMENTS

A. Cribbing, sheeting, and shoring shall be designed by a qualified person and meet the requirements of WAC 296-155.

B. The Contractor shall be exclusively responsible for providing the services of the competent person and registered professional engineer, as referenced in WAC 296-155-650, relating to excavation, trenching, and shoring. Representatives of the Owner and the Engineer shall not be required to perform the roles of competent person or registered professional engineer as defined in WAC 296-155-650.

C. Adequate sheeting, shoring, bracing, sloping, dewatering, or other methods of sustaining the stability of the floor and walls of the excavation shall be utilized as necessary to support the excavation under loading conditions that exist or arise during construction. This may require watertight shoring methods.

D. Means and methods shall protect and not adversely impact the structures or facilities, existing or constructed. Dewatering, if employed in conjunction with a shoring system, shall be in accordance with Sections 31 23 43 – Earthwork.

E. Noise, vibrations, and settlement associated with installing, maintaining, and removing the excavation support systems shall comply with all applicable ordinances and regulations.

PART 2 : PRODUCTS

Not Used.

PART 3 : EXECUTION

3.01 CRIBBING, SHEETING, AND SHORING

A. Install and maintain shoring, sheeting, bracing, and sloping necessary to support the sides of the excavation and to prevent movement that may damage adjacent facilities, delay the work, or endanger life and health. Conform to the requirements of WISHA and other applicable governmental regulations and agencies.

B. The Contractor shall be solely responsible for making and maintaining excavations in a safe manner.

C. Proper design and installation of the shoring and associated dewatering systems, method of construction, and monitoring and protection of the structure excavations, shoring, existing structures and facilities are the responsibility of the Contractor. The Contractor shall ensure the integrity of existing structures and facilities are maintained and that appropriate construction techniques are employed at all times to protect existing, as well as installed, structures and facilities. In the event shoring becomes unstable or surface settlement occurs, the Contractor shall immediately implement corrective measures and notify the Engineer. The Contractor shall be solely liable for shoring and associated dewatering systems necessary to support the excavations under loading conditions that may exist or arise during construction.

D. Use any combination of shoring and overbreak, tunneling, boring, sliding trench shield, or other method allowed by the applicable local, State, and Federal safety codes.

E. Carefully reconsolidate the bedding and side support behind a movable box prior to placing backfill.

F. Sheet piling and timbers in trench and other excavations shall be withdrawn in a manner so as to prevent subsequent settlement of structures or pipe, or additional backfill loading that might overload the pipe. Reconsolidate bedding/backfill to the satisfaction of the Engineer.

G. Leave in place those portions of cribbing and sheeting extending below the crown elevation of the pipe unless the bedding and side support can be reconsolidated to the satisfaction of the Engineer.

H. Where shoring or movable trench shields extend below the top of a pipe and are to be removed, locate at least one pipe diameter away from the pipe. They may be located closer only if the Contractor demonstrates to the Engineer's satisfaction a means of reconsolidation.

I. If a movable box is used in lieu of cribbing or sheeting, and the bottom cannot be kept above the springline of the pipe, the bedding or side support shall be carefully reconsolidated behind the movable box prior to placing initial backfill.

J. Where removal of sheeting would result in damage to adjacent utilities or other property, the Engineer may order all or a portion of sheeting to be cut off and left in place.

K. Do not use horizontal strutting below the barrel of a pipe.

L. Do not use the pipe as support for trench bracing.

M. Damages resulting from improper shoring and failure to shore shall be the sole responsibility of the Contractor.

3.02 TRENCH EXCAVATION SAFETY SYSTEMS

A. Protect utility trench excavation in excess of 4 feet in depth with a safety system conforming to the referenced requirements.

B. The Contractor's trench safety system shall be designed by a qualified person and meet the referenced requirements.

3.03 PAYMENT

Costs associated with providing, installing, and maintaining adequate excavation support systems as specified herein shall be included in and paid under bid item "Excavation Support Systems".

END OF SECTION

SECTION 32 12 16
HOT MIX ASPHALT (HMA) PAVING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Temporary and permanent hot mix asphalt (HMA) paving.

1.02 STANDARDS AND CODES

A. Federal Specifications (FS):

1. TT-P-115F, Paint, Traffic (Highway, White and Yellow).

B. Standard Specifications for Road, Bridge, and Municipal Construction, 2020 by the Washington State Department of Transportation.

C. Construction Manual: Washington State Department of Transportation, 2019 as amended to date.

D. AASHTO T 209 – Standard Method of Test for Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA) Paving Mixtures.

1.03 MISCELLANEOUS

Should conflicts arise between Standard Specifications of government agencies mentioned herein and these Contract Documents, these Contract Documents shall govern.

1.04 SUBMITTALS

A. Submit in accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions.

B. Product technical data including:

1. Acknowledgement that products submitted meet requirements of standards referenced.
2. Manufacturer's installation instructions.

C. HMA concrete design mix.

PART 2 : PRODUCTS

2.01 MATERIALS

A. HMA

1. Asphalt Binder: PG 64-22 as set forth in Section 9-02.1(4) of the Standard Specifications.

2. Hot Mix Asphalt: HMA Class ½-inch as set forth in Section 9-03.8(2) of the Standard Specifications.

3. Aggregate: Per Section 9-03.8 of the Standard Specifications for HMA Class 1/2-inch.

B. ASPHALT SEAL COAT: AR-2000 asphalt binder.

C. LINE PAINT

1. Nonreflective.

2. White.

3. FS TT-P-115F.

2.02 MIXES

A. Mix shall comply with Section 5-04 of the Standard Specifications:

1. Equivalent single axle load (ESAL) shall be > 3 million and less than 10 million.

PART 3 : EXECUTION

3.01 PREPARATION

A. SUBGRADE PREPARATION

1. Prepare using methods, procedures, and equipment necessary to attain required compaction densities, elevation, and section.

2. Scarify and re-compact top 6 IN of fills and embankments that will be under paved areas.

3. Remove soft or spongy areas and replace with aggregate material.

4. Compact subgrade to 95 percent relative density per ASTM D1557.

5. Assure moisture content of structural fill is within 3 percent of its optimum to achieve required compaction density.

6. Following compaction, trim and roll to exact cross section:

a. Check with approved grading template.

7. Coordinate with the Engineer for density tests on subgrade to determine that subgrade complies with the Specification.

B. AGGREGATE COURSE

1. Place material in not more than 6 IN thick layers.

2. Spread, shape, and compact all material deposited on the subgrade during the same day.

3. Compact to 95 percent relative density per ASTM D1557.

C. LOOSE AND FOREIGN MATERIAL: Remove loose and foreign material immediately before application of paving.

D. APPURTENANCE PREPARATION

1. Adjust manholes, inlets, valve boxes and any other utility appurtenances to design grade after new HMA pavement has been installed.

3.02 INSTALLATION

A. Construct to line, grade and section as shown on the Drawings and in accordance with the Standard Specifications.

B. Spread prime coat uniformly on compacted aggregate top course at rate of 0.05 to 0.10 GAL per square yard.

C. Compact each lift to a minimum of 92 percent of the maximum density, as determined by AASHTO Test Method T 209:

1. Level of compaction shall be determined as the average of not less than 5 nuclear density gauge tests taken on the day the mix is placed at randomly selected locations within each lot.
2. Quantity represented by each lot shall be no greater than a single day's production or approximately 400 tons, whichever is less.
3. Cores taken within 48 hours of placement of the mix may be used as an alternative to the nuclear density gauge tests.
4. HMA pavement not meeting the prescribed minimum density standard shall be removed and replaced with satisfactory material at the Contractor's expense.

D. Seal joints between new HMA and existing asphalt surface with AR-2000 seal coat that is at least 12-inches wide, centered on the joint.

E. TEMPORARY HMA PAVEMENT

1. HMA pavements that are installed and subsequently removed by the Contractor.
2. Install to a minimum depth of one inch over 3 inches of crushed surfacing top course.
3. Provide a suitable and safe driving surface for traffic and pedestrians by compacting with a roller or vibratory plate to provide a smooth driving surface. “Wheel-rolling” is not acceptable.
4. Remove and dispose of temporary HMA pavement prior to installing permanent HMA pavement.
5. Install temporary HMA pavement over all trenches in streets that currently have asphalt paving. Maintain temporary HMA pavement until permanent HMA pavement is installed.
6. Temporary HMA pavement that fails due to rutting, spalling, or other means, as determined by the Engineer, shall be repaired by the Contractor at no cost to the Owner.

F. LINE PAINTING

1. Thoroughly clean surfaces which are to receive paint.
2. Make completely dry before paint is applied.
3. Do not paint until a minimum of five (5) days has elapsed from time surface is completed:
   a. A longer period may be required if directed by the Engineer.
   b. Provide temporary striping as needed.
4. Do not apply paint over wet surfaces, during wet or damp weather, or when temperature is below 40 DegF.
5. Markings and striping shall be applied to match existing.

3.03 FIELD QUALITY CONTROL

A. Comply with Section 5-04 of the Standards Specifications.

B. Composite pay factors will not be used.

C. No deductions will be made for the weight of asphalt binder, blending sand, mineral filler, or any other component of the mixture.

D. If HMA is rejected or subsequently removed as a function of the Contractor's means and methods for obtaining the final grades and thicknesses shown on the Drawings, the material removed will not be included in the measured quantity being paid.

END OF SECTION

SECTION 32 14 13.19
PERMEABLE INTERLOCKING CONCRETE PAVEMENT

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Permeable interlocking concrete pavers.
2. Crushed stone bedding material.
3. Open-graded subbase aggregate.
4. Open-graded base aggregate.
5. Bedding and joint/opening filler materials.
6. Edge restraints.
7. Geotextiles.

1.02 STANDARDS AND CODES

A. Standard Specifications for Road, Bridge, and Municipal Construction, 2020 by the Washington State Department of Transportation.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M-288 Geotextile Specification for Highway Applications.

C. American Society of Civil Engineers (ASCE):

1. ASCE 68-18 Permeable Interlocking Concrete Pavements.

D. ASTM International (ASTM)

1. C29 Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate.
2. C33 Specification for Concrete Aggregates.
3. C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
4. C136 Method for Sieve Analysis for Fine and Coarse Aggregate.
5. C140 Standard Test Methods of Sampling and Testing Concrete Masonry Units.
6. C936 Standard Specification for Solid Interlocking Concrete Pavers.
7. C979 Specification for Pigments for Integrally Colored Concrete.
8. C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units.
9. C1781 Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems.

10. D448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
11. D698 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft3 (600 kN-m/m3)).
12. D3385 Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer.
13. D5268 Specification for Topsoil Used for Landscaping Purposes.
14. E2835 Standard Test Method for Measuring Deflections using a Portable Impulse Plate Load Test Device.

E. Interlocking Concrete Pavement Institute (ICPI) Technical Bulletins:

1. Permeable Interlocking Concrete Pavement manual (5th edition).
2. Permeable Design Pro software for hydrologic and structural design.
3. Tech Spec 18 Construction of Permeable Interlocking Concrete Pavements.
4. Tech Spec 23 Maintenance of Permeable Interlocking Concrete Pavements.

1.03 SUBMITTALS

A. Submit in accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions.

1. Manufacturer's drawings and details: Indicate perimeter conditions; junction with other materials and assemblies; expansion and control joints; paver layout patterns, color arrangement, and installation and setting details. Indicate layout, pattern, and relationship of paving joints to fixtures, and project formed details.
2. Minimum 3 lb samples of subbase, base and bedding aggregate materials.
3. Sieve analysis of aggregates for subbase, base, and bedding materials per ASTM C136.
4. Project specific or producer/manufacturer source test results for void ratio and bulk density of the base and subbase aggregates.
5. Permeable concrete pavers:
    a. Paver manufacturer's catalog sheets with product specifications.
    b. Four representative full-size samples of each paver type, thickness, color, and finish. Submit samples indicating the range of color expected in the finished installation. Accepted samples become the standard of acceptance for the work of this Section.
    c. Laboratory test reports certifying compliance of the concrete pavers with ASTM C 936.
    d. Manufacturers' material safety data sheets for the safe handling of the specified paving materials and other products specified herein.

e. Manufacturer's written quality control procedures including representative samples of production record keeping that ensure conformance of paving products to the product specifications.

6. J. Paver Installation Subcontractor:

a. Demonstrate that job foremen on the project have a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program and a record of completion from the PICP Installer Course.

b. Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.

c. Written Method Statement and Quality Control Plan that describes material staging and flow, paving direction, and installation procedures, including representative reporting forms that ensure conformance to the project specifications.

1.04 QUALITY ASSURANCE

A. PAVER INSTALLATION SUBCONTRACTOR QUALIFICATIONS

1. Utilize an experienced installer who has successfully completed concrete paver installations similar in design, material, and extent indicated for this Project.

2. Utilize an installer with job foremen holding a current record of completion from the Interlocking Concrete Pavement Institute PICP Installer Technician Course.

B. Single-source Responsibility: Obtain each color, type, and variety of grids, joint materials and setting materials from single sources with resources to provide products and materials of consistent quality, appearance, and physical properties without delaying progress of the Work.

C. Review the manufacturers' quality control plan, paver installation subcontractor's Method Statement and Quality Control Plan with a pre-construction meeting of representatives from the manufacturer, paver installation subcontractor, general contractor, engineer and/or owner's representative.

D. MOCK-UP

1. Locate where directed by the Owner.

2. Notify Owner in advance of dates when mock-ups will be installed.

3. Install a minimum 10 ft x 10 ft paver area. Mechanized installations may require a larger mock-up area. The size of the mock-up area shall be determined during the pre-construction meeting.

4. The mock-up area shall be used to determine surcharge of the bedding layer, joint sizes, joint lines, laying pattern(s), color(s), and texture.

5. This area shall be used as the standard by which the work is judged.

6. Subject to acceptance by the Owner, mock-up may be retained as part of the finished work. If mock-up is not retained, Contractor shall remove and properly dispose of it.
7. Subject to acceptance by the Owner, a site visit and approval by the Owner during the first day of paving may substitute for a mock-up.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Deliver materials in manufacturer's original, unopened, undamaged container packaging with identification tags intact on each paver bundle.

1. Deliver concrete pavers to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by forklift or clamp lift.
2. Unload pavers at job site in such a manner that no damage occurs to the product or existing construction.

C. Store materials in protected area such that they are kept free from mud, dirt, and other foreign materials.

D. Cover sand with waterproof covering to prevent exposure to rainfall or removal by wind. Secure the covering in place.

E. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.

1.06 ENVIRONMENTAL CONDITIONS

A. Do not install bedding materials or paver units during heavy rain or snowfall.

B. Do not install bedding materials and paver units over frozen base materials.

C. Do not install frozen bedding materials.

PART 2 : PRODUCTS

2.01 PERMEABLE INTERLOCKING CONCRETE PAVER UNITS

A. MANUFACTURER

1. Mutual Materials.
2. Accepted Equal.

B. PAVER TYPE

1. Eco-Priora.
2. Uni Ecoloc.
3. Accepted Equal.

C. MATERIAL STANDARD

1. Comply with ASTM C936.
2. Color: Provide color pallet to Owner for selection of color.
3. Color Pigment Material Standard: Comply with ASTM C979.
4. Concrete pavers shall have spacer bars on each unit. Overall dimensions do not include spacer bars.

2.02 CRUSHED STONE FILLER, BEDDING, BASE, AND SUBBASE MATERIALS

A. Crushed stone with 90% fractured faces, LA Abrasion < 40 per ASTM C131.

B. Do not use rounded river gravel.

C. All stone materials shall be washed with less than 2% passing the No. 200 sieve.

D. Base and subbase materials shall have a minimum 0.32 porosity per ASTM C29.

E. Joint/opening filler, bedding, base, and subbase: Conform to ASTM D448 gradation as shown in Tables 1, 2 and 3 below:

Table 1: ASTM No. 8 Bedding and Joint/Opening Filler

Sieve Size	Percent Passing
½ inch	100
⅜ inch	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No.16	0 to 5

ASTM No. 89 or No. 9 stone may be used to fill pavers with narrow joints.

Table 2: ASTM No 57 Base Material

Sieve Size	Percent Passing
1½ inch	100
1 inch	95 to 100
½ inch	25 to 60
No. 4	0 to 10
No. 8	0 to 5

ASTM No. 3 or No. 4 stone may be used as subbase material if ASTM No. 2 stone is unavailable.

Table 3: ASTM No2 Subbase Material

Sieve Size	Percent Passing
3 inch	100
2½ inch	90 to 100
2 inch	35 to 70
1½ inch	0 to 15
¾ inch	0 to 5

F. Do not use limestone screenings.

G. PRODUCT SUBSTITUTIONS: Gradations other than those specified for crushed stone jointing material, base and subbase materials shall be approved in writing by the project engineer.

2.03 EDGE RESTRAINTS

A. Provide edge restraints installed around the perimeter of all concrete paver unit areas as follows:

1. Poured in place cement concrete curb per WSDOT Standard Plan F-10.12 with cut-outs for overflow drainage.
2. Accepted equal.

2.04 GEOTEXTILE FABRIC:

A. MATERIAL TYPE AND DESCRIPTION: Soil stabilization geotextile fabric for Class II soil conditions.

B. MANUFACTURER: Acceptable to concrete paver unit manufacturer

PART 3 : EXECUTION

3.01 EXAMINATION

A. Contractor shall inspect, accept, and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers.

1. Verify that drainage, subgrade preparation, compacted density and elevations conform to specified requirements.
2. Verify that base materials, thickness, surface tolerances and elevations conform to specified requirements.
3. Provide written density test results for soil subgrade and base materials to the Owner and paver installation subcontractor.
4. Verify location, type, and elevations of edge restraints, concrete collars around utility structures, and drainage pipes and inlets.

5. Verify that geotextiles have been placed according to drawing and specifications.

B. Do not proceed with installation of bedding and interlocking concrete pavers until subgrade soil conditions meet the specified requirements.

3.02 PREPARATION

A. SUBGRADE PREPARATION

1. Prepare using methods, procedures, and equipment necessary to attain required compaction densities, elevations, and sections.
2. Scarify and re-compact top 6 IN of fills and embankments that will be under paved areas.
3. Remove soft or spongy areas and replace with aggregate material.
4. Compact subgrade to 95 percent relative density per ASTM D1557.
5. Assure moisture content of structural fill is within 3 percent of its optimum to achieve required compaction density.
6. Following compaction, trim and roll to exact cross section:
7. Check with approved grading template.
8. Coordinate with the Engineer for density tests on subgrade to determine that subgrade complies with the Specification.

B. AGGREGATE COURSE

1. Place material in not more than 6 IN thick layers.
2. Spread, shape, and compact all material deposited on the subgrade during the same day.
3. Compact to 95 percent relative density per ASTM D1557.

C. Remove loose and foreign material immediately before application of paving.

D. Adjust manholes, inlets, valve boxes and any other utility appurtenances to design grade, including concrete collars as necessary, prior to installing pavers.

E. Verify that the soil base and subgrade are free from standing water.

F. Stockpile joint/opening filler, base, and subbase materials such that they are free from standing water, uniformly graded, free of any organic material or sediment, debris, and ready for placement.

G. EDGE RESTRAINT PREPARATION

1. Install edge restraints per the drawings and manufacturer’s recommendations.
2. Mount directly to finished base. Do not install on bedding sand.

3.03 INSTALLATION

A. GENERAL

1. Any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities shall be removed before application of the [geotextile] and subbase materials.
2. Keep area where pavement is to be constructed free from sediment during entire job. Base and bedding materials contaminated with sediment shall be removed and replaced with clean materials.
3. Do not damage drainpipes, overflow pipes, observation wells, or any inlets and other drainage appurtenances during installation. Report any damage immediately to the Owner.

B. GEOTEXTILES

1. Place on soil subgrade as shown on the Drawings. Secure in place to prevent wrinkling from vehicle tires and tracks.
2. Overlap all seams a minimum of 12 in. in the direction of drainage.

C. OPEN-GRADED SUBBASE AND BASE

1. Moisten, spread, and compact the subbase in maximum 8 in. lifts without wrinkling or folding the geotextile. Place subbase to protect geotextile from wrinkling under equipment tires and tracks. Do not place subbase aggregate on a subgrade or geotextile with water ponded on it. Do not damage underdrain pipes.
2. For each lift, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10-ton vibratory roller until there is no visible movement of the stone. Do not crush aggregate with the roller.
3. Use a minimum 13,500 lbf plate compactor with a compaction indicator to compact areas that cannot be reached by the vibratory roller. Do not crush the aggregate with the plate compactor.
4. Surface tolerance of the compacted subbase shall be ±2½ in. over a 10 ft straightedge.
5. Moisten, spread, and compact the base layer in one 4 in. thick lift.
6. On this layer, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10-ton vibratory roller until there is no visible movement of the stone. Do not crush aggregate with the roller.
7. The surface tolerance the compacted base shall not deviate more than. ±1 in. over a 10 ft straightedge.

D. BEDDING LAYER

1. Moisten, spread, and screed the bedding material. Maintain a consistent 2 in. thickness prior to compaction with the pavers.
2. Fill voids left by removed screed rails with bedding material.

3. The surface tolerance of the screeded bedding layer shall be ±3/8 in over a 10 ft straightedge.

4. Do not subject screeded bedding material to any pedestrian or vehicular traffic before paving unit installation begins.

5. Permeable interlocking concrete pavers and joint/opening fill material.

   a. Lay the paving units in herringbone pattern with joint widths between 1/16 and 3/16 of an inch. Maintain straight pattern lines.

   b. Fill gaps at the edges of the paved area with cut units. Cut pavers subject to tire traffic shall be no smaller than 1/3 of a whole unit.

   c. Cut pavers and place along the edges with a masonry saw.

   d. Fill the openings and joints with No. 8 stone or stone meeting the paver manufacturer's recommendations.

   e. Remove excess aggregate on the surface by sweeping pavers clean.

   f. Compact and seat the pavers into the bedding material using a low-amplitude, 75-90 Hz plate compactor capable of at least 5,000 lbf. This will require at least two passes with the plate compactor.

   g. Do not compact within 6 ft of the unrestrained edges of the paving units.

   h. Apply additional aggregate to the openings and joints if needed, filling them completely. Remove excess aggregate by sweeping then compact the pavers. This will require at least two passes with the plate compactor.

   i. All pavers more than 6 ft off the laying face shall be left fully compacted by the completion of each day.

   j. The final surface tolerance of compacted pavers shall not deviate more than ±3/8 under a 10 ft long straightedge.

   k. The surface elevation of pavers shall be 1/8 to 1/4 in. above adjacent drainage inlets, concrete collars, or channels.

3.04 FIELD QUALITY CONTROL

A. After sweeping the surface clean, check final elevations for conformance to the drawings.

B. Lippage: No greater than 1/8 in. difference in height between adjacent pavers.

C. The surface of the pavers may be 1/8 to 1/4 in. above the final elevations after compaction to help compensate for possible minor settling normal to pavements.

D. The surface elevation of pavers shall be 1/8 to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars, or channels.

E. Bond lines for paver courses: ±½ in. over a 50 ft taut string line.

F. Verify the surface infiltration at a minimum of 100 in./hour using test method C1781.

3.05 PROTECTION

A. After work in this section is complete, Contractor shall protect paved area from sediment deposition and damage due to subsequent construction activity on the site.

B. PICP installation contractor shall return to site after 6 months from the completion of the work and provide the following as required:

1. Fill paver joints with No. 8 stone.
2. Replace broken or cracked pavers.
3. Re-level settled pavers to initial elevations.
4. Any additional work shall be considered part of original bid price and with no additional compensation.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Black vinyl chain link fencing and gates.

B. Related Specification sections include but are not necessarily limited to:

1. Section 31 23 43 - Earthwork.
2. Section 03 31 10 – Concrete Mixtures.

1.02 STANDARDS AND CODES

A. ASTM International (ASTM):

1. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. A824, Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain-Link Fence.
3. F552, Standard Terminology Relating to Chain Link Fencing.
4. F567, Standard Practice for Installation of Chain-Link Fence.
5. F626, Standard Specification for Fence Fittings.
6. F668, Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
7. F900, Standard Specification for Industrial and Commercial Swing Gates.
8. F934, Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
9. F1043, Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework.
10. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
11. F1184, Standard Specification for Industrial and Commercial Horizontal Slide Gates.
12. F1664-08(2018), Standard Specification for Polyvinyl Chloride (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.
13. F1665-08(2018), Standard Specification for Polyvinyl Chloride (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used with Chain-Link Fence

B. American Welding Society (AWS).

1.03 QUALITY ASSURANCE

A. Installer bonded and licensed in the Project state.

B. Installer shall have a minimum two (2) years of experience successfully installing similar fencing.

C. Utilize only AWS certified welders.

1.04 DEFINITIONS

A. See ASTM F552.

B. NPS: nominal pipe size, in inches.

C. Installer or applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.05 SUBMITTALS

A. Submit in accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions.

B. Product technical data including:

1. Acknowledgement that products submitted meet requirements of standards referenced.
2. Manufacturer's installation instructions.

C. Scaled plan layout showing spacing of components, accessories, fittings, and post anchorage.

D. Mill certificates.

E. Source quality control test results.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Fence systems:
   a. Cyclone.
   b. Anchor Fence, Inc.

B. Submit request for substitution in accordance with Division 1, Section 1-06.6.

2.02 COMPONENTS

A. CHAIN LINK FABRIC

1. Fabric type:
    a. PVC-coated steel:
        1) ASTM F668, Class 2B thermally fused and bonded.
        2) Galvanized core wire, ASTM A641, Class 3.
2. Core wire gage: 11 gauge
3. Mesh size: 2 IN diamond shape.
4. Selvage treatment:
    a. Top: Twisted and barbed.
    b. Bottom: Twisted and barbed.
5. PVC color per ASTM F934, Black.

B. CONCRETE: See Specification Section 03 31 10.

C. LINE POST

1. ASTM F1083 pipe:
    a. Schedule 40, NPS 2 IN.
2. Fusion-bonded vinyl coating 10 - 14 mils thick; color to match fabric.

D. CORNER OR TERMINAL POSTS

1. ASTM F1083 pipe:
    a. Schedule 40, NPS 2-1/2 IN.
2. Fusion bonded vinyl coating 10 - 14 mils thick; color to match fabric.
3. Securely fasten barb wire arm, projected outward at 45 degrees to support 3 strands of barbed wire.

E. BRACE AND RAILS

1. ASTM F1083 pipe:
    a. Schedule 40, NPS 1-1/4 IN.
2. Fusion bonded vinyl coating 10 - 14 mils thick; color to match fabric.

F. TENSION WIRE

1. Top and bottom of fabric:
    a. ASTM F 1664, Class 2b, 7 gauge.
2. Fusion bonded vinyl coating 10 - 14 mils thick; color to match fabric.

G. Fence fittings including, but not limited to, post and line caps, rail and brace ends, sleeves-top rail, tie wires and clips, tension and brace bands, stretcher (tension) bars, truss rods:

1. ASTM F626.
2. Fusion bonded vinyl coating 10 - 14 mils thick; color to match fabric.
3. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Rail Sleeves
    a. Pressed steel
    b. Minimum zinc coating 1.20 oz/ft^2
4. Tension and brace bands
    a. Minimum steel thickness 12 gauge.
    b. Minimum width ¾ IN
    c. Minimum zinc coating 1.20 oz/ft^2
5. Truss Rod Assembly
    a. 3/8 IN diam. with pressed steel tightener
    b. Minimum zinc coating 1.20 oz/ft^2
    c. Assembly capable of withstanding a tension of 2,000 lbs.
6. Stretcher (Tension) Bar
    a. Minimum cross section of 3/16 IN by 3/4 IN
    b. Length 2 inches less than fabric height.
    c. Minimum zinc coating 1.20 oz/ft^2

H. SWING GATE

1. ASTM F900.
2. Materials as specified for fence framework and fabric.
3. Hardware:
    a. Galvanized per ASTM A153/A153M.
    b. Fusion bonded vinyl coating 10 - 14 mils thick; color to match fabric.
    c. Hinges to permit 90-degree in and out gate opening.
4. Drop bar locking device.
    a. Galvanized per ASTM A153/A153M.
    b. Fusion bonded vinyl coating 10 - 14 mils thick; color to match fabric.
    c. Stop to hold gate open and a center rest with catch.
5. Heavy duty padlock with stainless steel core and two keys per gate.

2.03 SOURCE QUALITY CONTROL

A. Test related fence construction materials to meet the following standards:

1. Posts and rails: ASTM F1043, Heavy Industrial.

PART 3 - EXECUTION

1.02 INSTALLATION

A. Install in accordance with:

1. Manufacturer's instructions.
2. Lines and grades shown on Drawings.
3. ASTM F567.

B. Do not start fence installation before site is cleared, grubbed and final grading is complete and finish elevations are established.

C. Drill holes in firm, undisturbed or compacted soil.

D. Concrete around posts shall be worked thoroughly to remove voids and crowned to carry water away from the posts.

E. Place fence with bottom edge of fabric at maximum clearance above grade, as shown on Drawings:

1. Correct minor irregularities in earth to maintain maximum clearance.
2. It is expected that in the performance of this work that handwork may be required where sufficient width does not exist for machine work.

F. Space line posts at equal intervals not exceeding 10 FT OC.

G. Provide post braces and adjustable truss rods for each gate, corner, pull and terminal post and first adjacent line post.

H. Install stretcher (tension) bars full-height of fabric.

I. RAILS

1. Fit rails with expansion couplings of outside sleeve type.
2. Rails continuous for outside sleeve type for full length of fence.

J. Provide expansion couplings in top rails at not more than 20 FT intervals.

K. Anchor top rails to main posts with appropriate wrought or malleable fittings.

L. Install bracing assemblies at all end and gate posts, as well as side, corner, and pull posts:

1. Locate compression members at mid-height of fabric.

2. Extend diagonal tension members from compression members to bases of posts.
3. Install so that posts are plumb when under correct tension.

M. Pull fabric taut and secure to posts and rails:

1. Secure so that fabric remains in tension after pulling force is released.
2. Secure to posts at not over 15 IN OC, and to rails at not over 24 IN OC, and to tension wire at not over 24 IN OC.
3. Use U-shaped wire conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two (2) full turns.
4. Bend ends of wire to minimize hazards to persons or clothing.

N. Install post top at each post, fastened securely to the post.

O. GATES

1. Construct with fittings or by welding.
2. Provide rigid, weatherproof joints.
3. Assure right, non-sagging, non-twisting gate – posts shall be plumb in the closed condition.
4. Hinge and latch offset opening space from the gate frame to the post shall be no greater than 3 IN in the closed position.
5. Coat any field welds with rust preventive paint, color to match post coating.
6. Direction of swing inward or as otherwise shown on drawings.

END OF SECTION

SECTION 32 91 19
TOPSOILING AND FINISHED GRADING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Topsoiling and finished grading.

B. Location of work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.02 STANDARDS AND CODES

A. ASTM International (ASTM):

1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
2. E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves.

1.03 SUBMITTALS

A. Submit in accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions.

B. PROJECT DATA: Test reports for furnished topsoil.

1.04 PROJECT CONDITIONS

Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary, to complete work.

PART 2 : PRODUCTS

2.01 MATERIALS

A. TOPSOIL

1. Two-way soil mix of 50% composted organic mulch and 50% sand, sandy loam, or silty sand high in organic content blended with compost.
2. Well combined, free of weeds, rocks debris and other deleterious materials that will not pass through a 7/16-inch sieve.
3. Shall not contain sawdust or other fresh wood byproducts.
4. Acceptable Sources:
    a. EMU Topsoil, Poulsbo, WA.
    b. Peninsula Topsoil, Belfair, WA.

c. Cedar Grove Compost Company, Maple Valley, WA.

d. Or accepted equal.

2.02 TOLERANCES

FINISH GRADING TOLERANCE: 0.1 foot plus/minus from required elevations.

PART 3 : EXECUTION

3.01 GENERAL

A. Proceed as rapidly as the Site becomes available, consistent with normal seasonal limitations for soil preparation work.

B. Subgrade to consist of native soils or placed soils that will provide plants with nutrients, positive drainage and appropriate particle sizes that promote long-term plant health and stability.

C. Immediately notify the Engineer of poorly draining or unacceptable drainage conditions within landscape areas that will affect the health and maturation of new plantings.

D. SOIL MOISTURE CONTENT

1. Do not work soil when moisture content is so great that excessive compaction will occur. A person walking across subgrade or planting soil shall not depress soil more than one inch.
2. Do not work soil when it is so dry that dust will form in the air or when clods will not break readily.

E. Keep streets, sidewalks, and project area clean and free from debris.

F. Protect prepared soils from disruption by other work and construction activities.

3.02 SUBGRADE PREPERATION

A. Clear existing grass within limits of areas to be sodded or hydroseeded.

B. Loosen grade to a depth of 4 inches.

C. In areas with existing tree roots or within tree driplines, hand cultivate soil to a depth of 4 inches taking care not to damage existing root systems.

3.03 ROUGH GRADE REVIEW

Prior to placing topsoil, the Engineer shall review subgrades for acceptance.

3.04 SOIL PREPARATION AND PLACING TOPSOIL

A. Place sufficient depth of planting soil to achieve finish grade as indicated on the Drawings and to provide allowance for one-inch depth of settlement.

B. Place planting soil mix to a depth of 3 inches.

C. Roll and compact planting soil at 85 percent maximum density per ASTM D1557.

3.05 FINISH GRADE

A. Provide finished surface free of stones, sticks, or other material 1 inch or more in any dimension.

B. Provide finished surface smooth and true to required grades.

C. Restore stockpile area to condition of rest of finished work.

3.06 ACCEPTANCE

A. Upon completion of topsoiling, obtain the Engineer's acceptance of grade and surface.

B. Make test holes where directed to verify proper placement and thickness of topsoil.

END OF SECTION

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SECTION 32 92 33
SEEDING, SODDING, AND LANDSCAPE PLANTING

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Seeding, sodding, and landscape planting.
    a. Seeding to be performed at the Pump Station 19 and Pump Station 31 sites.

1.02 STANDARDS AND CODES

A. American Nursery and Landscape Association/American National Standards Institute (ANLA/ANSI):

1. Z60.1, American Standard for Nursery Stock.

B. AOAC International (AOAC).

C. ASTM International (ASTM):

1. D2028, Standard Specification for Cutback Asphalt (Rapid-Curing Type).
2. D5276, Standard Test Method for Drop Test of Loaded Containers by Free Fall.

D. Standard Specifications for Road, Bridge, and Municipal Construction, 2020 by the Washington State Department of Transportation.

1.03 QUALITY ASSURANCE

A. QUALITY CONTROL

1. With the exception of cuttings, all plant material furnished by the Contractor shall conform to the requirements of the current issue of “American Standard for Nursery Stock”.
2. Inspections will be made by the Engineer or other Owner representative. The Contractor shall request inspection at least 24 hours in advance of the time inspection is required. Inspections at the following times will be required:
    a. When subgrade has been established and scarified.
    b. After topsoiling and finished grading has been completed.
    c. After layout of all plant material.
    d. At the initial completion of work.
    e. For Final Acceptance of all work.

3. Fertilizer:

   a. If the Engineer determines fertilizer requires sampling and testing to verify quality, testing shall be performed at the Contractor's expense, in accordance with current methods of the AOAC.

   b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.

   c. If minimum rates of application have not been met, the Contractor will be required to distribute additional quantities to make up minimum application specified.

B. QUALIFICATIONS

1. All work shall be performed by a licensed Landscape Contractor registered in the State of Washington and shall be qualified for landscaping work through certification by the Washington Association of Landscape Professionals (WALP) or by the Washington State Nursery and Landscape Association (WSNLA).

2. Pruning work to be performed by a licensed Arborist.

1.04 SUBMITTALS

A. Submit in accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions.

B. Product technical data including:

1. Acknowledgement that products submitted meet requirements of standards referenced.

2. Manufacturer's installation instructions.

3. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.

4. Source and location of mulch, sod, plants, and plant material.

C. SAMPLES

1. Mulch.

2. Compost.

D. MAINTENANCE PLAN

1. Type written maintenance plan and schedule for the Owner's use following the Contractor's maintenance period.

2. Submit prior to final acceptance.

E. INFORMATIONAL SUBMITTALS

1. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.05 SEQUENCING AND SCHEDULING

A. INSTALLATION SCHEDULE

1. Provide schedule showing when trees, shrubs, ground covers and other plant materials are anticipated to be planted.
2. Show schedule of when lawn type and other grass areas are anticipated to be planted.
3. Indicate planting schedules in relation to schedule for finish grading and topsoiling.
4. Indicate anticipated dates the Engineer will be required to review installation for initial acceptance and final acceptance.

B. PRE-INSTALLATION MEETING

1. Meet with the Engineer and other parties as necessary to discuss schedule and methods, unless otherwise indicated by the Engineer.

PART 2 : PRODUCTS

2.01 MATERIALS

A. SOD

1. Viable, dense, strongly rooted, not less than two (2) years old.
2. Composed of the following or other mix of native species subject to approval by the Engineer:

Kind and Variety of Seed in Mixture	Percent by Weight
Red fescue (*Festuca rubra*)	50%
Idaho fescue (*Festuca idahoensis*)	50%

3. Free of weeds and undesirable native grasses.
4. Strips 12 to 18 IN wide.
5. Mow prior to stripping from field.
6. Cut so 3/4 IN of soil is firmly attached to roots.
7. Not frozen or dormant.

B. SEEDED LAWN

1. General: Grasses, legumes, or cover crop seed of the type specified shall conform to the standards for “Certified” grade seed or better as outlined by the State of Washington Department of Agriculture “Rules for Seed Certification”, current edition. Seed shall be furnished in standard containers on which shall be shown the following information:
   a. Common name of seed.
   b. Lot number.

c. Net weight.

d. Percentage of purity.

e. Percentage of germination (in case of legumes percentage of germination to include hard seed).

f. Percentage of weed seed content and inert material clearly marked for each kind of seed in accordance with applicable State and Federal law.

2. Upon request, the Contractor shall furnish to the Engineer duplicate copies of a statement signed by the materials person certifying that each lot of seed has been tested by a recognized and accredited seed testing laboratory within six months before the date of delivery on the project. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

3. The seed mixture and rate of application shall be as follows:

Kind and Variety of Seed in Mixture	Percent by Weight
Blue wildrye (*Elymus glaucus*)	50%
Red fescue (*Festuca rubra*)	30%
Idaho fescue (*Festuca idahoensis*)	20%

4. The rate of application shall be 8 pounds per 1,000 square feet. No noxious weeds will be permitted. The seed mixture shall be no less than 98% pure and shall have a minimum germination rate of 90%.

C. MULCHES AND AMENDMENTS

1. Hardwood mulches:

a. Mulch (for fine landscape areas):

1) Bark Mulch shall consist of Douglas fir, pine, or hemlock bark. It shall be ground so that on a loose volume basis, a minimum of 95 percent passes a 1-1/2-inch sieve and no more than 55 percent passes a 1/4-inch sieve.

2) The bark mulch shall not contain resin, tannin, or any other deleterious material that would be detrimental to plant life.

D. FERTILIZER

1. Commercial fertilizer meeting applicable requirements of State and Federal law.

2. Cyanic compound or hydrated lime are not permitted in mixed fertilizers.

3. For lawn-type seeding and sod: 5-10-5 analysis.

E. LIMESTONE: Agricultural grade ground limestone containing not less than 88 percent of combined calcium and magnesium carbonates, 100 percent passing a 10-mesh sieve, 90 percent passing a 20-mesh sieve, and 60 percent passing a 100-mesh sieve.

F. WATER

1. Water free from substances harmful to grass or sod growth.
2. Provide water from source approved prior to use.

G. PLANTS

1. See plants identified on the Drawings.
2. Sound, healthy, vigorous, with normal top and root systems, free from disease, insect pests or their eggs, grown in same or colder climatic zone as project:
   a. Nursery grown stock, freshly dug:
      1) No heeled-in, cold storage or collected stock.
   b. Species and size as indicated on Drawings.
3. Deciduous shade trees: Single leader, straight trunk, well-branched, free of branches up to 6 foot high, and with symmetrical growth.
4. Balled and burlapped plants (B&B): Firm, natural balls of soil.
5. Container grown plants (Cont): Roots well established in soil, grown in container for at least one growing season.

2.02 ACCESSORIES

A. TREE STAKES: 2 inch diameter pressure treated lodgepole pine wood stakes 8 foot in length with chamfered tops and 6 inch conical points.

B. STAKING WIRE: 12 gauge galvanized.

C. REINFORCED RUBBER HOSE: 5/8 or 3/4 inch diameter.

D. ANTIDESICCANT: Emulsion that will provide a film over plant surfaces permeable enough to permit transpiration.

PART 3 : EXECUTION

3.01 SOIL PREPARATION

A. GENERAL

1. Refer to Section 32 91 19 – Topsoiling and Finished Grading.
2. Limit preparation to areas that will be planted soon after.
3. Provide facilities to protect and safeguard all persons on or about premises.
4. Verify location and existence of all underground utilities:
   a. Take necessary precaution to protect existing utilities from damage due to construction activity.
   b. Repair all damages to utility items at sole expense.

5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism:

    a. The Contractor shall be responsible for vandalism until acceptance of work in whole or in part.

B. Preparation for lawn-type sodding:

1. Distribute topsoil to the depth as indicated in Section 32 91 19 – Topsoiling and Finished Grading.
2. Spread limestone uniformly over designated areas at a rate of 50 pounds per 1,000 square feet:

    a. Thoroughly mix and till through topsoil layer.

3. Prior to applying fertilizer, loosen areas to be sodded by tilling or other suitable device if the soil has become hard or compacted:

    a. Hand till as required near critical root zones of existing trees. Do not mechanically till or damage roots 2 inches or larger.

4. Distribute fertilizer uniformly over areas to be sodded at a rate of 12 pounds per 1,000 square feet.
5. Incorporate fertilizer into soil to a depth of at least 2 inches by tilling, raking, or other approved methods.
6. Correct surface irregularities in order to prevent pocket or low areas that will allow water to stand.
7. Grade lawn areas to a smooth, even surface with a loose, uniformly fine texture:

    a. Roll and rake, remove ridges, and fill depressions, as required to meet finish grades.

    b. Limit fine grading to areas which can be planted soon after preparation.

8. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.

3.02 INSTALLATION

A. SODDING

1. Notify the Engineer of source and location of sod at least 30 days prior to sodding operation, to permit inspection:

    a. Submit species and percentages of purity and state botanical and common names.

2. Sod areas as designated and disturbed lawn areas which were sodded or established prior to construction.
3. Perform sodding only during climatic or weather conditions conducive to successful results:

    a. Lay within 24 hours of stripping.

    b. Do not use dormant or frozen sod.

c. Sodding may be accomplished at all seasonal periods providing adequate provisions for sod protection are taken to ensure fitness and survival.

d. Do not place sod when temperature is below 32 DegF.

e. Do not place frozen or dried out sod.

f. Do not sod on frozen or dried out soil.

4. Lay sod to form a solid mass with tightly fitted joints:

a. Butt ends and edges; do not overlap.

b. Stagger joints.

c. Tamp or roll lightly to ensure full contact with subgrade.

d. Work sifted soil into minor cracks, avoid smothering adjacent grass.

5. Protection of sodded areas shall be provided using high visibility flagging and staking.

B. SEEDING

1. Seeded lawn installation shall proceed through the following sequence of steps in its construction and shall be coordinated with irrigation system, when applicable.

2. Areas to be seeded shall be installed either between March 1 and May 15 or between September 1 and October 1.

3. Areas to receive seed shall be cleared and grubbed, and the surface graded to a uniform surface including accommodating vertical clearances adjacent to improvements in this Section. If the surface is determined suitable for seeding by the Engineer, no topsoil or compost will be required. Where fill is required, planting soil mix shall be provided to bring the surface to finish grade. If the existing soil is unacceptable for seeding, the Contractor shall remove enough material to allow for the placement of a minimum of 2-inches of planting soil mix.

4. After the addition of any soil amendments and application of lime, the area shall be mechanically tilled to a depth of 4-inches to achieve a homogeneous blend. Soil shall then be raked by approved hand or mechanical methods to remove and dispose of all large clods, rocks, debris, and litter larger than 1-inch in any dimension.

5. The area shall then be rolled in 2 directions, the second rolling at right angles to the first. The roller shall be of a standard, waterfilled type to apply 150 to 300 pounds per square foot ground pressure.

6. The finished grade shall meet the vertical clearance requirements adjacent to improvements as specified in this Section.

7. Fertilizer shall be applied as specified in this Section. Coverage shall be uniform and all areas shall be covered.

8. Apply the Contract-specified seed mix by hydroseeding, mechanical, and hand application methods as the area may require.

9. Rake seed and fertilizer into the top 1/2 to 1-inch of soil to produce a uniform, dense lawn.
10. Roll the area in one (1) direction.
11. Water the rolled area with a 1-inch average depth of water without causing erosion and sedimentation.
12. Temporary flagging and warning signs shall be installed preventing the public from disturbing and damaging newly installed lawn.

3.03 PLANTING TREES, SHRUBS, AND GROUND COVERS

A. NOTIFICATION

1. Notify the Engineer of source of plants and plant materials at least 30 days prior to planting to permit the Engineer's inspection of source qualifications.

B. PREPARATION

1. Handle plants so that roots or balls are adequately protected from breakage of balls, from sun or drying winds:
    a. Ensure tops or roots of plants are not permitted to dry out.
2. During transportation, protect materials from wind and sun to prevent tops and roots from drying out.
3. Protect tops of plants from damage:
    a. Plants with damaged tops will be rejected.
4. For purpose of inspection and planting identification, attach durable, legible labels to bundle or container of plant material delivered at the planting site:
    a. State correct plant name and size of each plant in weather-resistant ink on labels.
5. Do not prune trees and shrubs at nursery.

C. PLANTING SEASON

1. Plant trees and shrubs and groundcover any time the ground is suitable between September 15 and June 1.

D. PLANTING PROCEDURE

1. Indicate locations of plants for approval by the Engineer before excavating plant locations.
2. In event underground construction, utilities, obstructions, or rock are encountered in excavation of plantings, secure alternate locations from the Engineer:
    a. Make said changes without additional compensation.
    b. Where tree locations fall under existing overhead wires, or crowd existing trees, adjust locations as directed by the Engineer.

3. Fertilizer:
   a. Apply fertilizer at a rate of 8 pounds per 1,000 square foot.
4. Excavate pits and beds as necessary and in accordance with ANLA/ANSI Z60.1:
   a. Loosen bottom of pits prior to planting.
   b. Excavation is unclassified, excavate all materials without additional cost.
5. Tree and shrub pits to be circular in shape with vertical sides at least one foot greater in diameter than ball diameter:
   a. Pit to be of sufficient depth to provide six inches of planting soil under ball when set to natural grade.
6. Shrub and ground cover beds:
   a. Plant shrubs used in mass plantings in individual holes of required size.
7. Set plants straight or plumb, in locations when indicated and at such level that after settlement they bear same relationship to finished grade as they did in their former setting:
   a. Carefully tamp planting soil under and around base of balls to prevent voids.
   b. Remove burlap, rope, and wires from top of balls.
   c. Do not remove burlap from sides and bottom of balls.
8. Backfill plants with planting soil:
   a. Tamp to 1/2 depth of pit and thoroughly water and puddle before bringing backfill to proper grade.
   b. After planting has been completed, flood pit again so that backfill is thoroughly saturated and settled.
9. After planting is complete, form a level saucer 3 IN high around each tree extending to limit of plant pit for watering purposes.
10. Mulch plant pit after saucer has been shaped:
    a. Mulch to limits of pit and uniformly over ground cover beds to a depth of 3 IN.
    b. In mass plantings of shrubs, mulch entire area uniformly among shrubs to a depth of 3 inches.
    c. If mulching is delayed and soil has dried out, water plants thoroughly before spreading mulch.
11. Staking: Stake trees immediately after planting:
    a. Place ties at top and bottom of wrapping material and not more than 12 IN apart between top and bottom ties.
12. Remove dead or damaged branches:
    a. Remove only dead or damaged branches from evergreens or deciduous plants.

13. Water plants during planting operations:

    a. Water each plant a minimum of once each week until final acceptance.

    b. Apply sufficient water to moisten backfill about each plant so that moisture will extend into the surrounding soil.

3.04 MAINTENANCE AND REPLACEMENT

A. GENERAL

1. Landscape establishment shall consist of the Contractor providing regularly scheduled, adequate, and proper care for all new planting for the landscape establishment period according to best practices per WALP. The landscape establishment period shall begin on the date of written notice from the Engineer of the acceptance of plantings and shall end 365 calendar Days thereafter unless the Contract specifies otherwise. Once all other Work is physically complete, the Contractor shall request an inspection for initial completion of the Work.

2. At least five (5) Working Days before the beginning of the landscape establishment period, the Contractor shall submit a maintenance and weed control plan for approval by the Engineer. The weed control plan shall identify the means, manner, methods, and timing intervals to assure weed control throughout the plant establishment period. This weed control plan will be subject to revision dependent on results of the implemented plan. The submittal shall also include a watering schedule indicating how and when each and every component of the landscaping receives water.

3. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is longer.

4. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.

5. Protection of new materials:

    a. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements indicated to remain.

    b. Repair and pay for all damaged items.

B. WEED CONTROL: The Contractor shall maintain all areas, whether mulched or not, in a weed-free condition during the landscape establishment period. Removal shall be by mechanical control methods unless alternatives are approved by the Engineer in writing.

C. PLANT REPLACEMENT: Replacement plants required during establishment shall be planted within a time period set by the Engineer, which will depend on the season and availability of the replacement plants. Missing plants shall be replaced by the Contractor in kind. Scheduling of plant replacement shall be coordinated with the Engineer.

D. INSPECTION: Plantings and landscaped areas will be inspected regularly by the Engineer during the landscape establishment period. Should the Engineer determine that the Contractor is not providing regular adequate and proper care of plant material or is performing unacceptable landscape establishment work, the Engineer will provide written notice to the Contractor of such condition. The Contractor shall reply to the Engineer within seven (7) Days of the date of written notice with proposed corrections. Such corrective measures shall occur within fourteen (14) Days after the date of written notice unless the Engineer agrees otherwise:

1. Approximately fifteen (15) Days before the end of the landscape establishment period, the Contractor shall request a final site inspection by the Engineer. Conditions found unacceptable by the Engineer shall be corrected by the Contractor within a ten (10)-Day period immediately following the inspection. After correction, the Contractor shall notify the Engineer for a re-inspection and written Final Acceptance. Corrective Work shall include replacement of dead, missing, or unacceptable landscaping material; weeding; pick-up of all litter; and repair and/or readjustment of the irrigation system. Necessary replanting shall be arranged by the Engineer in accordance with the best planting time of the year.

E. SEEDED OR SODDED LAWNS

1. Maintain sodded lawns: Thirty (30) Days, minimum, after installation and review of entire project area to be sodded.
2. Maintenance period begins at completion of planting or installation of entire area to be sodded.
3. The Engineer will review sodded lawn area after installation for initial acceptance.
4. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform lawn, and free of weeds and eroded or bare areas.
5. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas:
    a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
6. Mow lawns as soon as there is enough top growth to cut with mower set at recommended height for principal species planted:
    a. Repeat mowing as required to maintain height.
    b. Do not delay mowing until grass blades bend over and become matted.
    c. Do not mow when grass is wet.
    d. Time initial and subsequent mowing as required to maintain a height of 1-1/2 to 2 inch.
    e. Do not mow lower than 1-1/2 inch.

7. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose:

   a. Anchor as required to prevent displacement.

8. Replant bare areas using same materials specified.

9. The Engineer will review final acceptability of installed areas at the end of the maintenance period.

10. Maintain repaired areas until remainder of maintenance period or approved by the Engineer, whichever is the longer period.

F. TREES, SHRUBS, GROUNDCOVERS, AND EMERGENT PLANTINGS:

1. Maintenance includes, but is not limited to, watering when necessary; removing dead or dying branches; removing sprouts and suckers; tightening, repairing, or replacing tree stakes and wrapping; maintaining mulch to originally specified depth; and weeding plant beds and pits:

   a. For hand watered trees, fifteen (15) gallons shall be applied per tree per watering on a three (3) Day schedule.

2. Remove and replace all new plants supplied, which are impaired, dead, or dying during one (1) year from initial acceptance.

3. The Engineer will review completed planting for acceptability of installation:

   a. Approval of planting denotes initial acceptance and the beginning of the maintenance period.

END OF SECTION

SECTION 33 05 16
UTILITY STRUCTURES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. Precast concrete manholes, vaults, pump station wet well, and accessories.

1.02 STANDARDS AND CODES

A. ASTM International (ASTM):

1. A48, Standard Specification for Gray Iron Castings.
2. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. C150, Standard Specification for Portland Cement.
4. C443, Standard Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets.
5. C478, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
6. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
7. C858, Standard Specification for Underground Precast Concrete Utility Structures.
8. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
9. C1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
10. C1619, Standard Specification for Elastomeric Seals for Joining Concrete Structures.

B. AASHTO Standard Specification for Highway Bridges.

C. ACI 318 Building Code Requirements for Structural Concrete.

D. Standard Specifications for Road, Bridge, and Municipal Construction, 2020 by the Washington State Department of Transportation.

E. Reference Document: Geotechnical Engineering Technical Memorandum, Silverdale Pump Station 19 Upgrades, October 14, 2020, Landau Associates.

F. Reference Document: Geotechnical Engineering Technical Memorandum, Silverdale Pump Station 31 Upgrades, October 14, 2020, Landau Associates.

1.03 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Product technical data including:
    a. Catalog data.
    b. Acknowledgement that products submitted meet requirements of standards referenced.
    c. Manufacturer's installation instructions.
2. Fabrication and/or layout drawings:
    a. Include detailed diagrams of precast structures showing typical components and dimensions, reinforcements, weights, and other details.
    b. Itemize, on separate schedule, sectional breakdown of each catch basin, manhole, and vault structure with all associated components and refer to drawing identification number or notation.
    c. Indicate knockout elevations for all piping entering each precast structure coordinated with the location and elevation of pipe and conduit shown on the Drawings.
3. Cement concrete mix design.
4. Reinforcement design based on specified Design Requirements in Paragraph 1.04.
5. Buoyancy design calculations for precast structures.
6. Structural design calculations based on the Basis of Rational Design, stamped by a professional engineer licensed by the State of Washington.
7. Manhole and wet well vacuum test results.

1.04 DESIGN REQUIREMENTS

A. Normal weight concrete per Specification Section 03 31 10 – Concrete Mixtures.

B. Minimum concrete cover over reinforcement shall not be less than that required by ACI 318, if greater than ASTM C858 unless shown otherwise noted on the Drawings.

C. MINIMUM LOADING REQUIREMENTS

1. Loading assumptions, unless noted otherwise on the Drawings, shall conform to ASTM C857 except as follows:
    a. Top slabs shall be designed for A-16 (HS20-44) Loading OR 250 PSF Live Loading, whichever is greater, unless otherwise indicated.

b. Wall and bottom slab design and uplift calculations shall include hydrostatic pressure from groundwater, with a design groundwater elevation equal to the ground surface, as recommended by the referenced Geotechnical Engineering Technical Memorandums prepared by Landau Associates.

c. Live loads and weights for post-installed items such as internal piping, pumps, valves, sewage, concrete grout fill, etc. shall not be included in the buoyancy calculations.

d. Buoyancy calculations shall have a minimum factor of safety equal to 1.5.

e. Buoyancy resistance forces may include the following:

1) Weight of the precast structure.

2) Weight of the cast-in-place top slab shown on the Drawings within a footprint of 1 foot beyond outside edge of the precast structure.

3) Buoyant soil weight within the footprint of the extended base slab.

4) Buoyant soil weight within a wedge defined from the outside of the extended base slab to ground surface assuming a soil friction angle of 20 degrees. Frictional resistance forces between the concrete and soil may not be used for resistance in the buoyancy calculations.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Precast Concrete Structures:

a. Oldcastle Precast (basis of design).

b. H^2 Pre-cast Inc.

c. Or accepted equal.

2. Watertight Manhole Frame and Cover:

a. East Jordan Company.

b. Or accepted equal.

3. Manhole Steps:

a. Bowco Industries, Inc.

b. Parson Environmental Products, Inc.

c. American Step Company, Inc.

d. Or accepted equal.

4. Premolded Joint Compound:
   a. ConSeal: CS-231 or* CS-440, Concrete Sealants, Inc.
   b. Kent Seal, Hamilton Kent.
   c. Or accepted equal.
5. Exterior Joint Wrap:
   a. ConSeal CS-212, Concrete Sealants, Inc.
   b. WrapidSeal, CCI Pipeline Systems.
   c. Or accepted equal.

B. Submit request for substitution in accordance with Section 1-06.6 of the WSDOT Division 1 Special Provisions.

2.02 MANHOLE/WET WELL AND VAULT STRUCTURE COMPONENTS

A. MANHOLE/WET WELL COMPONENTS

1. Reinforcement: ASTM C478.
2. Concrete Mix:
   a. Constructed with Portland ASTM C150, Type I/II cement blend for a marine environment.
3. Minimum wall and base thicknesses: As determined by precast manufacturer based on specified Design Requirements, minimum if noted on the Drawings.
4. Provide the following components for each manhole/wet well structure as appropriate:
   a. Extended base (precast) with integral bottom section. Extended base dimensions and thickness shall be determined by precast manufacturer to accommodate the specified Design Requirements in Paragraph 1.04. Extended base shall be designed to the minimum dimensions noted on the Drawings.
   b. Precast bottom section(s).
   c. Precast barrel section(s), minimized to reduce number of joints.
      1) Joints shall be located a minimum 6 inches from a pipe penetration, cast or cored.
   d. Precast eccentric transition section.
   e. Precast adjuster ring(s).
   f. Precast concrete transition section.
5. Provide manhole section with minimum inside dimensions as shown on the Drawings, minimum 48 IN.
6. Interior and exterior surfaces shall be sacked and/or ground smooth to provide a uniform surface.
7. Wrap all joints with 8-inch wide Exterior Joint Wrap after installation.

8. Coat interior and exterior surfaces of manholes and wet wells as specified in Section 09 96 00 – Painting and Protective Coatings.

9. Manholes and wet wells shall be vacuum tested and visually inspected as specified in this Section.

B. VAULTS COMPONENTS

1. Reinforcement: ASTM C478.

2. Concrete Mix:

   a. Constructed with Portland ASTM C150, Type I/II cement blend for a marine environment.

3. Minimum dimensions: As indicated on the Drawings.

4. Minimum wall thicknesses: As determined by precast manufacturer based on specified Design Requirements, minimum if noted on the Drawings.

5. Provide the following components for each vault:

   a. Extended base (precast) with integral bottom section. Extended base dimensions and thickness shall be determined by precast manufacturer to accommodate the specified Design Requirements in Paragraph 1.04. Extended base shall be designed to the minimum dimensions noted on the Drawings.

      1) Cast floor drain specified in Section 22 05 00 – Common Work Results for Plumbing into base.

      2) Pitch floor at a minimum of 1/4-inch per foot to drain during casting or with high strength non-shrink grout.

   b. Precast bottom section(s).

   c. Precast riser section(s) minimized to reduce number of joints.

      1) Joints shall be located a minimum 6 inches from a pipe penetration, cast or cored.

   d. Precast solid wall and solid center construction.

   e. Aluminum ladder as shown on the Drawings.

6. Interior and exterior surfaces shall be sacked and/or ground smooth to provide a uniform surface.

7. Wrap all joints with 8-inch wide Exterior Joint Wrap after installation.

8. Coat interior and exterior surfaces of vaults as specified in Section 09 96 00 – Painting and Protective Coatings.

C. PIPE PENETRATIONS IN PRECAST STRUCTURES

1. Pipe and conduit penetrations larger than 6 inches in diameter shall be precast with the structure in the location and elevations shown on the Drawings. All penetrations below 6 inches in diameter may be core drilled in the field by the Contractor if allowed by the precast manufacturer.

D. WATERTIGHT MANHOLE FRAME AND COVER

1. Frame and cover shall meet load rating EN124:1994 C250.
2. Frame material shall be grey iron, Class 35B; Cover shall be ductile iron (80-55-06).
3. Clear opening shall be as shown on the Drawings.
4. Cover shall be watertight with a replaceable gasket.
5. All component parts shall be resistant to chemical attack, fuels, salt and water or a combination of the above over the lifespan of the cover and frame. Surface discoloration is acceptable in service.
6. Manhole frame and cover shall be cast into a precast flat top of diameter and thickness shown on the Drawings.

E. MANHOLE STEPS

1. Injection molded copolymer polypropylene conforming to ASTM D4101 that encapsulates a 1/2-inch diameter, Grade 60 ASTM A615 deformed steel reinforcing bar.
2. Meet ASTM C478, ASTM C497, AASHTO M199, and OSHA related standards.
3. Steps provided in accordance with ASTM C478 shall conform to ANSO 14.3.

F. JOINT TREATMENT

1. Joints of precast manholes/wet wells and vault base, riser, and top sections:
   a. Manholes/Wet Well: rubber gaskets conforming to ASTM C443.
   b. Other Joints: Rubber gasket or self-sealing mastic type waterstop, Greenstreak, Lockstop, or accepted equal to provide a watertight seal on the interior.

G. HIGH STRENGTH, NON-SHRINK GROUT: as specified in Section 03 60 00 – Grout.

PART 3 : EXECUTION

3.01 MANHOLE/WET WELL AND VAULT CONSTRUCTION

A. Precast concrete manholes/wet wells and vaults with integral bottom section:

1. Ensure accurate vertical placement and leveling prior to placement.
2. Provide vertical alignment tolerance of maximum 1 IN horizontal to 10 FT vertical.

3. Prechannel manhole inverts with a semi-circular bottom conforming to the inside contour of the adjacent sewer sections:

    a. Channels shall be prechanneled with concrete extending to the spring line of the largest diameter pipe penetration or higher.

    b. Shape inverts accurately and smoothly to minimize turbulence and give them a steel trowel finish.

    c. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit.

    d. Slope benches from the manhole wall towards the channel at a minimum of 1/4 inch per foot.

4. Build each manhole and vault structure to dimensions shown on the Drawings and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.

5. Provide reinforcing around openings for pipe or duct penetrations per ACI 318.

B. For all horizontal mating surfaces between concrete and concrete or concrete and metal, seal joints with rubber gaskets in a manner similar to pipe joints conforming to ASTM C443 or ASTM C1619. In addition, all joints shall be provided with an Exterior Joint Wrap.

C. Catch basins, manholes/wet wells, vaults, and inlets shall be watertight.

D. Pipe to manhole connections as shown on the Drawings.

E. Joints in structures shall be located a minimum 6 inches from a pipe penetration, cast or cored.

F. Set and adjust frame and cover final 6 IN (minimum) to 18 IN (maximum) to match finished pavement or finished grade elevation using precast adjuster rings.

3.02 FIELD QUALITY CONTROL

A. MANHOLE/WET WELL TESTING

1. Vacuum Testing:

    a. Prior to backfill and interior coating installation, vacuum test manholes and wet well system according to ASTM C1244.

2. Visual Inspection Testing:

    a. After backfill and release of groundwater to its natural level, observe inside of structure for groundwater infiltration. Contractor shall perform corrective action as approved by the Engineer to eliminate any infiltration, at no cost to the Owner.

B. Precast reinforced concrete risers and tops shall be subject to rejection on account of failure to conform to any Specification requirements. In addition, individual sections of risers and tops may be rejected because of any of the following reasons:

1. Fractures or cracks passing through shell, except for single end crack not exceeding depth of joint.
2. Defects indicating imperfect proportioning, mixing, and molding.
3. Surface defects indicating honeycombed or open texture.
4. Damaged ends where such damage would prevent making satisfactory joint.
5. Manhole steps out of line or not properly spaced.
6. Visible infiltration.
7. Internal diameter of section varying more than 1 percent from nominal diameter.
8. Any continuous crack having surface width of 0.01 inch or more and extending for length of 12 inches or more, regardless of position.

END OF SECTION

SECTION 40 61 13
PROCESS CONTROL SYSTEM GENERAL PROVISIONS

PART 1 : GENERAL

1.01 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 control cabinet(s) (MCP), I/O, and associated equipment and instrumentation.
2. Motor starters and power distribution equipment.
3. Field Instrumentation, installation and calibration requirements.
4. Shop and field testing, and calibration of power & control system components and equipment.

1.02 SYSTEM DESCRIPTION

A. Provide 4 PLC based control panel (MCP) with Allen Bradley CompactLogix and MicroLogix PLCs for all equipment control, monitoring and alarming.

B. Provide field instrumentation and control devices and installation details.

C. Coordinate and implement controls for motor controllers.

D. Coordinate controls for vendor package control panels, including the following:

1. Diesel Engine Driven Pump
2. Engine Generator Control Panel
3. Fuel Monitoring Control Panel

1.03 SYSTEM INTEGRATOR

A. The System Integrator shall be responsible for the final design and assembly of the instrumentation and control system and control panels.

B. All programming of the PLC and operator interface shall be by the System Integrator.

C. The System Integrator shall configure the relocated Radio and set up and test connection to Owner’s existing telemetry and process visualization system.

D. The System Integrator shall be responsible for the final design and assembly of the entire I&C system. 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. The system shall readily enable manual operation of any and all functions in the event of failure of any one component.

E. The Contractor shall select one System Integrator from the following acceptable companies:

1. Quality Controls - Lynnwood, Washington
2. Technical Systems, Inc. - Lynnwood, Washington

F. Other alternate System Integrators, not listed, are not acceptable.

1.04 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.

1.05 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" X 17". 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" X 17" 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 Engineer for review and approval.

1.06 SUBMITTALS

A. In accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions, and Section 26 00 00, General Electrical, 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 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),

      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.

1.07 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.

1.08 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 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" thick machine engraved laminated phenolic having black letters not less than 3/16" 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 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.

PART 2 : PRODUCTS

2.01 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.

2.02 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. Magnetic type with contacts normally open held closed when door is closed. Switches shall have anodized finish and be furnished with 3-foot stainless steel armored cable. Sentrol 2500 series or accepted equal.

2.03 WIRE MARKERS:

Field installed wire markers shall be T&B, SHRINK-KON HVM or accepted equal.

2.04 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 1 spare compact logix PLC processor to match, complete with Ethernet communications and all other options.
2. Qty 1 spare (non-installed) PLC input and output card of each type used.
3. Qty 1 spare power supply of each type and rating used.
4. Qty 1 Relay of each type used or 10 % whichever is the greater amount.
5. Qty 10 lamps of each type used or 100% whichever is the greater amount.
6. Qty 200% spare fuses (two spare fuses for each fuse supplied).
7. Provide 10 spare nameplates 3” square or less with 20 letters 1/2” or less to be specified by the Owner.
8. Qty 1 Copy of final PLC program on a thumb drive. Final PLC program copy to include annotation and descriptors.

PART 3 : EXECUTION

3.01 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.

3.02 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.

3.03 TELEMETRY REPLACEMENT.

A. The Contractor must maintain constant monitoring of the sewage levels and pump status. In the event of an abnormality, the Contractor must respond to prevent flooding, spillage, overflow, and damage to the system.

B. Provide onsite observer or temporary alarm dialing system to a remote monitoring system to continuously monitor the bypass pumping system.

1. It is acceptable to use the existing telemetry panel or provide a temporary panel.
2. Use of the new telemetry panel provided under this contract is not acceptable for the bypass system.
3. In addition to the Contractor’s monitoring system, the bypass system must also be monitored by the County’s existing telemetry system control panel outside of construction working hours.

C. The Contractor must configure the following i/o points to be monitored by the County’s telemetry system:

1. High Level Alarm
2. Pump Fail
3. Normal Power Failure

3.04 FACTORY TESTING & INSPECTION

A. Prior to delivery to the site, the power & control panels shall be tested by the System Integrator. All control devices shall be operated, and the cabinet shall be powered with rated incoming voltage for at least 2 days. Simulating equipment shall be provided and wired into the control cabinet system for this testing. The entire control system shall be interconnected as it will be installed in the field. If the actual equipment is not available, then simulation equipment shall be provided to fully demonstrate the functionality of the system. The System Integrator shall test all functionality of the system and verify proper operation of the hardware and software.

B. Following the System Integrators testing, the power & control panel shall be tested and inspected by the Design Engineer prior to shipment to the project site. The testing shall include, but not be limited to, operation of all input and output (I/O) points, control devices and motor controllers and demonstration of all control functions with the actual equipment or via a simulation. The System Integrator shall revise, modify, adjust the system as required by the Engineer during the testing period. The System Integrator shall inform and coordinate the time of the testing with the Engineer at least 4 weeks prior to the testing date.

C. The System Integrator shall provide working space, a 6-foot table and 2 office/desk chairs for the test Engineers.

D. If the Integrator's shop where the factory testing will take place is more than 100 miles from downtown Seattle, the System Integrator shall include in the contract price the cost to fly 2 engineers round trip to the shop where the panel is built plus an additional $800 for other travel expenses, meals, lodging, etc.

3.05 STARTUP AND TESTING

A. All components of the control system shall be calibrated by the Manufacturer after completion of installation. Each component shall be adjusted to be within the Manufacturer's required range and for the specific application.

B. Components that cannot be properly calibrated or that are found to exceed the Manufacturer's specified range or accuracy shall be removed and replaced at no additional cost to the Owner.

C. The control system shall be placed into operation by the Contractor and System Integrator.

D. All components shall be tested and recorded on check-off forms and shall be witnessed by the Engineer.

3.06 FIELD TESTING OF THE CONTROL SYSTEM

A. GENERAL

1. When the installation is substantially complete, the Contractor shall commence field testing of the control system. This shall determine that all system components connect up correctly to each other so that the system works as designed.

2. Field testing of the control system shall take place in 4 phases.
    a. Continuity Testing,
    b. I/O Testing,
    c. Program Testing
    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 81/2x11” 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. **Definition: Successfully I/O Tested**. 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. 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 Engineer and Contractor, with the Owner 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 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 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.

3.07 COMMISSIONING

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.

3.08 SYSTEM MAINTENANCE

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.

3.09 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 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

3.10 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. System schematics / shop drawings
9. Electronic copy on CD ROM of all shop drawings in AutoCAD version 2016 or newer
10. As-built wiring diagrams of cabinet and enclosure contained assemblies
11. Catalog data and complete parts list for all equipment and control devices
12. Listing of recommended spare parts
13. Listing of recommended maintenance tools and equipment.

B. Two (2) hard copies of the entire O&M manual shall be provided.

C. One (1) copy of the entire O&M manual shall be provided in electronic PDF format on CD ROMs.

3.11 RECORD DRAWINGS

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 OF SECTION

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SECTION 40 61 93.19
PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies general description for I/O and PLC configuration.

1. Pump Station 19 Main Control Panel

B. This section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this section. The electrical Drawings and schedules included in this project manual are functional in nature and do not specify exact locations of equipment or equipment terminations.

C. 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. The description of the individual signals are shown on the drawings.

1.02 PROCESSOR UNIT

Rack	Slot	Type	Description
1	1	Processing Unit	Rockwell Automation (Allen Bradley) CompactLogix 5370 w/ 3 Megabytes of memory or greater

1.03 POWER SUPPLY UNIT

Rack	Position	Type	Description
1	Between 1 and 2	Power Supply	4 ampere at 24 volts direct current user power supply
2	Between 3 and 3	Power Supply	4 ampere at 24 volts direct current user power supply

END OF SECTION

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SECTION 40 61 93.31
PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies general description for I/O and PLC configuration.

1. Pump Station 31 Main Control Panel

B. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this section. The electrical Drawings and schedules included in this project manual are functional in nature and do not specify exact locations of equipment or equipment terminations.

C. 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. The description of the individual signals are shown on the drawings.

1.02

1.03 PROCESSOR UNIT

Rack	Slot	Type	Description
1	1	Processing Unit	Rockwell Automation (Allen Bradley) CompactLogix 5370 w/ 3 Megabytes of memory or greater

1.04 POWER SUPPLY UNIT

Rack	Position	Type	Description
1	Between 1 and 1	Power Supply	4 ampere at 24 volts direct current user power supply
2	Between 1 and 2	Power Supply	4 ampere at 24 volts direct current user power supply

END OF SECTION

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SECTION 40 61 93.T19
PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies general description for I/O and PLC configuration.

1. Pump Station 19 Telemetry Control Panel

B. This section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this section. The electrical Drawings and schedules included in this project manual are functional in nature and do not specify exact locations of equipment or equipment terminations.

PART 2 : PRODUCTS

2.01 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.

2.02 CHASSIS LAYOUT

Rack	Slot	Type	Description
--	0	PLC	Processing Unit
--	1		
--	2		
--	3		
--	4		
--	5		

2.03 PROCESSOR UNIT

Rack	Slot	Type	Description
1	1	Processing Unit	Rockwell Automation (Allen Bradley) MicroLogix 1400 Memory Module

2.04 POWER SUPPLY UNIT

Not Used.

2.05 DISCRETE INPUTS

Rack	Slot	Channel	Description
--	0	0	Utility Power Fail
--	0	1	Flood Alarm
--	0	2	High Level Alarm
--	0	3	Low Level Alarm
--	0	4	Common Pump Fail
--	0	5	Generator/Engine Alarm
--	0	6	Intrusion Alarm
--	0	7	Common Motor Starter Fail
--	0	8	Chlorine Alarm (Not Used)
--	0	9	Pump 1 Running
--	0	10	Pump 2 Running
--	0	11	Diesel Engine Pump Running ~~Pump 3 Running (Not Used)~~*
--	0	12	Spare
--	0	13	Spare
--	0	14	Spare
--	0	15	Spare

2.06 DISCRETE OUTPUTS

Rack	Slot	Channel	Description
--	0	0	Spare
--	0	1	Spare
--	0	2	Spare

Rack	Slot	Channel	Description
--	0	3	Spare
--	0	4	Spare
--	0	5	
--	0	6	Spare
--	0	7	Spare
--	0	8	Spare
--	0	9	Spare
--	0	10	Spare
--	0	11	Spare

2.07 ANALOG OUTPUTS

Rack	Slot	Channel	Description	Range
--	0	0		0 - 10 V
--	0	1		0 - 10 V

2.08 ANALOG INPUTS

Rack	Slot	Channel	Description	Range
--	0	0	Total Station Flow to Telemetry Panel	0 GPM - 2500 GPM 0 - 10 V
--	0	1	Wet Well Level to Telemetry Panel	0 Feet - 30 Feet 0 - 10 V

PART 3 : EXECUTION

3.01 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.

END OF SECTION

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SECTION 40 61 93.T31
PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies general description for I/O and PLC configuration.

1. Pump Station 31 Telemetry Control Panel

B. This section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this section. The electrical Drawings and schedules included in this project manual are functional in nature and do not specify exact locations of equipment or equipment terminations.

PART 2 : PRODUCTS

2.01 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.

2.02 CHASSIS LAYOUT

Rack	Slot	Type	Description
--	0	PLC	Processing Unit
--	1		
--	2		
--	3		
--	4		
--	5		

2.03 PROCESSOR UNIT

Rack	Slot	Type	Description
1	1	Processing Unit	Rockwell Automation (Allen Bradley) MicroLogix 1400 Memory Module

2.04 POWER SUPPLY UNIT

Not Used.

2.05 DISCRETE INPUTS

Rack	Slot	Channel	Description
--	0	0	Utility Power Fail
--	0	1	Flood Alarm
--	0	2	High Level Alarm
--	0	3	Low Level Alarm
--	0	4	Common Pump Fail
--	0	5	Generator/Engine Alarm
--	0	6	Intrusion Alarm
--	0	7	Common Motor Starter Fail
--	0	8	Chlorine Alarm (Not Used)
--	0	9	Pump 1 Running
--	0	10	Pump 2 Running
--	0	11	Pump 3 Running (Not Used)
--	0	12	Spare
--	0	13	Spare
--	0	14	Spare
--	0	15	Spare

2.06 DISCRETE OUTPUTS

Rack	Slot	Channel	Description
--	0	0	Spare
--	0	1	Spare
--	0	2	Spare

Rack	Slot	Channel	Description
--	0	3	Spare
--	0	4	Spare
--	0	5	
--	0	6	Spare
--	0	7	Spare
--	0	8	Spare
--	0	9	Spare
--	0	10	Spare
--	0	11	Spare

2.07 ANALOG OUTPUTS

Rack	Slot	Channel	Description	Range
--	0	0		0 - 10 V
--	0	1		0 - 10 V

2.08 ANALOG INPUTS

Rack	Slot	Channel	Description	Range
--	0	0	Total Station Flow to Telemetry Panel	0 GPM - 2500 GPM 0 - 10 V
--	0	1	Wet Well Level to Telemetry Panel	0 Feet - 30 Feet 0 - 10 V

PART 3 : EXECUTION

3.01 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.

END OF SECTION 40 61 93.T31

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SECTION 40 61 96
PROGRAMMING WASTEWATER PUMP STATIONS

PART 1 : GENERAL

1.01 PROGRAMMING

A. The System Integrator shall provide all programming for the pump stations.

B. The System Integrator shall provide all programming of the PLC and operator interface for a complete user friendly interface and control of the pump stations.

C. The System Integrator shall provide telemetry system and modem and communications configuration, PLC programming and testing for interface back to the headquarters for data, monitoring and alarming of all pump station equipment, functions, instruments, etc.

1. The Owner will provide a PLC Program for the Contractor to use for the Telemetry Control Panel. The System Integrator may be directed to modify the programming for the Telemetry Control Panel.
2. The System Integrator shall provide all other programming, configuration, and modifications unless noted otherwise.

D. Any required SCADA system programming for telemetry or process visualization at the headquarters will be done by the Owner.

E. Programming of the pump stations shall be done in such a manner that future troubleshooting and system modifications can be accomplished efficiently.

F. All PLC registers must include descriptions to the highest extent possible.

1.02 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.

1.03 ALARM HANDLING

A. Alarm programming shall be developed such that alarm conditions will be managed in a common fashion.

B. All alarm conditions must have adjustable timers. When the alarm condition becomes true, the associated alarm timer will latch the alarm after the timer has expired. The alarm indication must continue until the acknowledge button is pressed.

C. Acknowledging an alarm does not clear or reset the alarm conditions, but simply turns off the associated horn & lights. If the alarm condition is still true when the reset button is pressed, then the alarm remains active. When the alarm condition has physically cleared and the reset button is pushed, then the alarm status is cleared.

1.04 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.

1.05 CONTROL DESCRIPTIONS AND PROGRAMMING

A. OPERATING MODES

1. There are three modes of operation: HAND, AUTO, and FLOAT CONTROL.

   a. HAND control of the pumps will run a pump at full speed.

   b. AUTO – pumps will operate from the PLC control based on the level transmitter level. Also, if high floats activate then the associated pump will be called to run for a time period at a preset speed. The PLC signals to the VFD (where installed) the pump speed set point.

   c. BACKUP FLOATS –pumps will also be called from a “hardwired float control” backup system with a direct input to the motor controller to call the pumps to operate at a preset speed for a time period set on a time delay relay associated with each pump.

      1) The PLC will observe the high-level float call and call the pump to run until the low-level float is actuated. The VFD has a dedicated input for starting and operating at a set speed.

2) The telemetry system will monitor and declare a high-level alarm if the High-High-Level float switch is actuated or the High-Level float switch actuates with the “Float Mode” selector switch is in the off position.

B. PUMP CONTROL (HAND & AUTO MODE)

1. Sewage pumps will be set point controlled via PLC / operator interface to start and stop on level.
2. Provide Lead and Lag and standby Stop and start setpoints.
   a. Lead, lag, and standby pumps will start and stop based on separate sets of level setpoints (operator adjustable on the operator interface).
   b. If the lead or lag pump fails – then the next pump will be called when the level setpoint is reached for the next pump.
3. Normal operation of the pumps is controlled by signals received from a submersible level transmitter mounted in the wet well.
   a. The level controller transmits a continuous level signal – the on/off levels and lead and lag and standby pump calls are generated by the PLC (Programmable Logic Controller) at pre-set levels selected by the operator thru the panel view operator interface mounted on the front of the control panel.
4. Hand-off auto switches located on the control panel door provide selected control of the pumps individually as follows:
   a. Hand position will bypass the level sensing equipment and floats and turn the pump on. Hand position will not operate the pump while an overload or pump motor over-temperature condition has been detected.
   b. Off position does not allow the pump to operate in any mode. This switch position is not to be used as a disconnect. For pump/motor maintenance; use the pump disconnect circuit breaker.
   c. Auto position allows the pumps to be controlled from the PLC level control programming or the hardwired backup, allowing normal automatic lead/lag operation and on/off based on wet well level setpoints.
5. Status and alarm lights located on the pump control panel are push-to-test type, providing local annunciation of following conditions:
   a. Pump - running (red)
   b. Pump Ready (green)
   c. Wet well high level (red)
6. Panelview Alarms:
   a. Pump - motor winding high temperature (red)
   b. Pump– leakage (amber)
   c. Individual annunciation for high level from transmitter and all high level floats

d. Low level transmitter and float alarms

e. Intrusion

f. Generator alarms

g. Engine Wastewater Pump alarms

7. The level sensing equipment transmits 4-20mA analog wet well level status data to headquarters via telemetry system equipment.

   a. Refer to the wet well elevation and details on the drawings for mounting method and the sensor elevation.

8. The control system receives wet well level alarm signals for high wet well and low wet well from float switches.

9. The following describes the alarm and status outputs available for local annunciation and transmission to headquarters, with exceptions noted:

   a. Pump Running – This status output is present for each pump while it is running. Individual green status lights are annunciated on the front of the pump control panel. Individual pump-run status signals are transmitted to headquarters via telemetry from motor starter auxiliary contacts.

   b. Pump Ready – operating and control power present, no failures, and switch in AUTO.

   c. Pump Fault:

      1) This alarm is activated individually for each pump upon tripping of the pump's overload or other condition. This alarm output will automatically shut down the pump.

      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 or the operations personnel reset the pump by pushing the reset push button.

   d. Pump High Winding Temperature:

      1) This alarm is activated individually for each pump when a thermal contact within the winding of the pump motor senses high temperature and opens.

      2) The contact is circuited to the PLC and will automatically shut down the pump and annunciate the alarm locally on the front of the pump control panel.

      3) The alarm can be transmitted to headquarters as “pump fail”. Upon cooling of the pump motor windings, the thermal contact will close and automatically allow the pump 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. Pump Leakage – This alarm is activated individually for each pump when a conductivity probe detects liquid in the motor housing. The probe is circuited to the PLC for leakage alarm indication. This condition will not automatically shut down the pumps. Once the leakage sensors clears (see pump maintenance literature for addressing leakage problem) the alarm will clear automatically.

f. High Wet Well:

1) This alarm is activated when one of the high-level floats are raised above the horizontal in the wet well. This occurs during either a failure of all pumps, a failure of the power source, a failure of the level transmitter, or extremely high flow conditions where both pumps cannot keep up with the flow.

2) All of the circuits associated with the high-level floats are from a separate source from the normal control power circuits for the normal auto PLC controls. A high-level condition is annunciated on the front of the panel and can be sent via telemetry. When the condition clears the alarm lights will de-energize. The high-level floats will also start the pumps as an automatic backup system described below.

g. Low Wet Well:

1) This alarm is activated when the low-level float is dropped below the horizontal in the wet well for a continuous time period of five seconds.

2) This situation occurs when either one of the pumps has failed to turn off, or when the pumps are operating on the back-up mercury floats. All of the circuits associated with the low-level float are supervised (normally energized).

3) When this circuit becomes de-energized, then a low-level condition is annunciated on the front of the panel and can be via telemetry. When the condition clears the alarm lights will de-energize.

4) The low-level float activation will shut down the pumps in auto control from the PLC and alarm. The low-level float is not interlocked with the backup hardwired float control or HAND operation of the pumps.

5) When operating in float control or HAND control the low level will be alarm only.

C. SPEED CONTROL

1. Calculate the VFD frequency based on measured level in the wet well.

a. Between the low pump speed level and high pump speed level, the PLC calculates a frequency proportionally between the high level and low level.

b. At or below the low pump speed level, the VFD frequency set point is at the minimum pump speed.

c. At or above the high pump speed level, the VFD frequency set point is at the minimum pump speed.

d. $f_{setpoint} = \frac{f_{max} - f_{min}}{L_{\max\_Speed} - L_{\min\_Speed}} \times L_{current} + f_{min}$

$f_{setpoint}$ frequency setpoint for the VFD
f_{max} maximum frequency setpoint (usually 60 Hz)
f_{min} minimum frequency setpoint (usually lowest to produce flow)
$L_{current}$ Current level as measured in wet well
L_{max} Wet well level corresponding to maximum frequency
L_{min} Wet well level corresponding to minimum frequency

2. It is not necessary to implement a speed control for constant speed motors, such as across the line starters or reduced voltage soft starts

D. PUMP ALTERNATION

1. Provide automatic alternation of the lead pump every 24 hours.

E. ENGINE PUMP AUXILIARY VACUUM PUMP

1. The liquid level in the engine wastewater pump is monitored by conductivity level probes.

   a. A low-low level switch (LSLL) indicates when the liquid level is below the engine pump volute level

   b. A low-level switch (LSL) indicated when the vacuum pump should be called to start and run for a set point period of time after the liquid level rises above the LSL.

2. The Vacuum pump will be controlled by the PLC / operator interface to start on a low level and operate for a period of time.

3. Alarms:

   a. “Fail to Prime” – if the LSL doesn’t indicate a higher level after a timeout period of time.

   b. “Prime Failure alarm” – If the level falls below the LSLL switch.

F. POWER FACTOR CORRECTION CAPACITOR

1. Connect the power factor correction capacitor while associated pump is operating and is at full speed.

   a. Disconnect power factor correction capacitor if connected to engine generator (through manual transfer switch).

G. A low-low level switch (LSLL) indicates when the liquid level is OPERATOR INTERFACE

1. The operator interface is a graphic control screen mounted on the face of the control panel. All wet well level setpoints and time delays for on/off control of the pumps can be modified from this interface.

2. The operator interface also displays all pump station information and monitoring showing equipment status such as wet well level, pump running / fail / ready status – flow rate, diesel pump, generator, and utility power status, etc.

3. The operator interface also displays all local alarms for equipment fail, trouble, high / low wet well, etc.

H. ALARM HANDLING

1. Alarm programming shall be developed such that alarm conditions will be managed in a common fashion.

2. All alarm conditions will have adjustable “de-bounce” timers. When the alarm condition becomes true, the associated alarm timer will latch the alarm after the timer has expired. 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.

3. Acknowledging an alarm does not clear or reset the alarm conditions, but simply turns off the associated horn and changes conditions on the PanelView. If the alarm condition is still true when the reset button is pressed, then the alarm remains active. When the alarm condition has physically cleared and the reset button is pushed, then the alarm status is cleared.

I. BUS COMMUNICATIONS

1. Establish bus communications between each motor controller (VFD, RVSS, SSOL, etc.). For each device, retrieve the following:

   a. All devices: Current or Last Fault Code

   b. VFD: Control location, DC power bus voltage, motor branch amperage (each phase), motor branch voltage, motor branch frequency feedback, motor branch frequency setpoint, thermal overload capacity (i.e., % until motor overtemperature trip), motor run-time (i.e., 1/100s or hour), motor starts, motor running

   c. RVSS: motor branch amperage (each phase), motor branch voltage, thermal overload capacity (i.e., % until motor overtemperature trip), motor run-time (i.e., 1/100s or hour), motor starts, motor running

   d. SSOL: motor branch amperage (each phase), motor branch voltage, thermal overload capacity (i.e., % until motor overtemperature trip), motor run-time (i.e., 1/100s or hour), motor starts, motor running

2. Establish bus communications to each engine control system (engine driven pump and engine generator)

   a. All devices: Present or Last Fault Code

   b. Engine: DC bus voltage, engine speed, engine run-time (i.e., 1/100s or hour), engine starts, engine running

3. Establish bus communications between each automatic transfer switch
   a. All devices: Present or Last Fault Code
   b. Each Switch: branch amperage (each phase), normal power branch voltage (each phase), normal power branch voltage (each phase), load connected to [nothing, emergency, normal]
4. Establish bus communications to each power meter
   a. All devices: Present or Last Fault Code
   b. Each Switch: branch amperage (each phase), normal power branch voltage (each phase), normal power branch voltage (each phase), load connected to [nothing, emergency, normal]

1.06 ADDITIONAL PROGRAMMING

A. The PLC will be programmed for additional equipment such as Diesel Pump, ATS, Intrusion System and all other monitored and controlled equipment associated with the pump station. Provide a separate subroutine for all additional equipment including telemetry.

B. GENERATOR (at PS19)

1. Monitor Running, Fail, Trouble and Low fuel signals.
2. Running signal is for future telemetry use.
3. Display engine fail, engine trouble and circuit breaker alarms. Group alarms with common alarm output to telemetry.

C. FUEL STORAGE (at PS19)

1. Monitor leak, high fuel, and low fuel signals.
2. Analog fuel level.
3. Display Fail, trouble and low fuel alarms. Group alarms with common alarm output to telemetry.

D. AUTOMATIC TRANSFER SWITCH (ATS) (at PS19)

1. Monitor position status.
2. Show fail, trouble and low fuel alarms. Group utility power fail alarm with power fail output to telemetry.

E. MANUAL TRANSFER SWITCH (MTS)

1. Monitor position status.
2. Show fail, trouble and low fuel alarms. Group utility power fail alarm with power fail output to telemetry.

F. CIRCUIT BREAKER STATUS

1. Monitor circuit breaker switch position.

2. Derive an alarm if power is unavailable because Circuit Breaker is not closed (engaged).

G. INTRUSION

1. Monitor intrusion status and display alarm.
2. Intrusion system entry and exit delays must be adjustable by operator.

H. Provide the telemetry output programming for the following alarm outputs to the telemetry control panel.

1. **High level** – parallel contacts from high level alarm float, and from PLC output for: high level indication from the level transmitter and high level float backup pumping system to a single terminal pair – provide programming as required for all alarm systems.
2. **Common Alarm** - Provide PLC output for a common alarm condition to telemetry for all alarms that are not otherwise specifically called for to be inputs to telemetry.
3. **Pump Fail** – provide programming for pump fail which consists of any of the following conditions: overload, overtemp, motor called to run and no running feedback from starter.
4. **Power Fail** – input from ATS and input from control power status relay and UPS trouble.

1.07 BACKUP AUTO (PLC) CONTROL SYSTEM (FLOAT CONTROL)

A. Backup control system that consists of 5 floats at pump station 19 and 3 floats at pump station 31. The float switches are physically offset by 3" to 4”.

B. PLC BACKUP FROM FLOATS

1. In case of a level transducer failure, provide control wiring and programming logic as follows for automatic backup from the PLC activated by the high and low level floats.
2. If high level float (LSH) is activated then the PLC shall start the lead pump and set a timer for it to run for a time period (selectable by the operator).
3. If high-high level float (LSH) is activated then the PLC shall start the lead and lag pumps and set a timer for both pumps to run for a time period (selectable by the operator).
4. High-high level control float must also be hard wired to telemetry in parallel with high level alarm float. The high-level float may indicates a high level alarm unless bypassed.
5. High- and low-level floats shall also be wired thru relay contacts to the PLC.
6. When the “Float Mode Only” switch is in the “Enabled” position, the telemetry PLC indicates a high level alarm on the high-high level float only instead of both high-level and high-high level floats.

C. FLOAT CONTROL BACKUP

1. In case of level transmitter failure, low float failure, PLC failure, etc.; provide a hardwired backup high-level float system (that is completely separate from the PLC) to start pumps and a time delay relay to shut off pumps.

   a. If the PLC has failed, then the high-level floats will activate the associated time delay relays and call on the pumps for a selected time period.

   b. High level float will call the lead pump (if in AUTO), if the level continues to rise to the high-high float level, then the lag pump will be called on for a selected time period.

   c. The lead pump is selected by a three-position selector switch with a position for “Pump 1”, “Alternate”, and “Pump 2”. While in the selector switch is in the “Pump 1” position, pump 1 will act as the lead pump. While in the selector switch is in the “Alternate” position, pump 1 and pump 2 will act as the lead pump depending on when the pumps stop. While in the selector switch is in the “Pump 2” position, pump 2 will act as the lead pump.

2. Backup control circuitry shall be powered from dedicated control power transformer for each motor starter.

3. The PLC monitors the low-level float. If the low-level float activates while the PLC operates in NORMAL control mode, the PLC must shut off the pumps. The telemetry panel sends an alarm for low level in the wet well. The low-level float must not disable the backup high level float system and must not shut off the pumps in HAND.

D. DIESEL ENGINE PUMP LEVEL CONTROL

1. The diesel pump operates primarily on a submersible level transmitter with start, stop, alarm, and flow control setpoints.

   a. The speed setpoint will be set to produce at least the minimum flow to prevent settling in the force main.

2. In case of a level transducer failure, provide control wiring and programming logic as follows for automatic backup from the PLC activated by the high and low level floats.

3. If high level float (LSH) is activated then the Engine shall start and stop the pump when the low level float is reached.

1.08 MISCELLANEOUS MONITORING & CONTROL

A. SAFETY AND SECURITY

1. Monitor intrusion status and display alarm. Intrusion system entry and exit delays must be adjustable by operator.

1.09 TOTALIZING

A. Provide Current Day, Previous Day, Current Month, Previous Month and Accumulative Runtimes and Start Counters for all equipment with run feedback (Sewage Pumps and Diesel Pump). 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.

1.10 OPERATOR INTERFACE

A. Provide screens to display all station monitoring data:

1. Overview screen with graphic display of pumps, wet well level, station flow, and force main pressure. This screen should also show the start/stop level setpoints and indicate if the float activated or not activated. Overview screen shall include – pump called, pump running, pump failed, lead and lag indication.
2. Provide a setpoint adjustment screen for the modification of the standard operational setpoints such as level and ramp control.
3. 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 & Flow Total data.

F. Also included will be alarm summary and alarm history screens.

G. Provide analog I/O scaling screens.

1.11 STARTUP & 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 sewage pump 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.

1.12 TRAINING & O&M MANUAL

A. Provide 8 hours of operator training of which will consist of pump operations, safety & 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.

END OF SECTION

SECTION 40 67 00
CONTROL PANELS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies general requirements for the process instrumentation.

B. The implementation of the process control scheme using instruments provided by the Contractor will be performed by the Owner's System Integrator. Unless noted otherwise, the System Integrator will not provide equipment specified in Division 40.

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.

		Rating
PS19	Main Control Panel	NEMA 1
PS19	Telemetry Panel	NEMA 1
PS19	Float Backup Control Panel	NEMA 4X
PS19	Pump 1 Motor Terminal Junction Box	NEMA 4X
PS19	Pump 2 Motor Terminal Junction Box	NEMA 4X
PS19	Sump Float Switch Intrinsically Safe Panel	NEMA 4X
PS19	Fuel System Monitoring Panel	NEMA 4X
PS31	Main Control Panel	NEMA 4X
PS31	Telemetry Panel	NEMA 4X
PS31	Motor Starter Control Panel	NEMA 4X
PS31	Wet Well Intrinsically Safe Terminal Box	NEMA 4X
PS31	Wet Well Motor Terminal Junction Box	NEMA 4X

1.02 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

1.03 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.

1.04 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.

1.05 WARRANTY

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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store and transport flow meter in accordance with the manufacturer's instructions.

1.07 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

2.01 ACCEPTABLE MANUFACTURERS

The Control Panel manufacturer shall be the system integrator identified in Section 40 61 13.

2.02 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 five (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 internally 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 two (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.

2.03 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.

2.04 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.

2.05 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 CompactLogix 5370 L36ERM for:
      1) PS19 Main Control Panel.
      2) PS31 Main Control Panel.
   b. Provide MicroLogix 1400 for:
      1) PS19 Telemetry Control Panel.
      2) PS31 Telemetry Control Panel.
   c. Provide modules as indicated.
   d. Provide power supply, filler slots, licenses and other appurtenances as required to make a functional system.
   e. 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. 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 1 spare fused disconnect for every 4 spare digital input terminals.

      2) Spare digital outputs shall all be provided with interposing relays with one form C output wired to two terminals for a normally open contact interface.

   b. For each spare analog input provide one fused, and two non-fused wired for a loop powered instrument input. Provide one shield ground terminal for every two spare analog inputs.

C. OPERATOR INTERFACE TERMINAL DEVICES

1. All operator interface devices mounted on the panel front shall be rated for the environment in which they will be located.

   a. In general, devices mounted on indoor panels shall be NEMA 12 rated.

   b. Operator devices mounted outdoors, or in wet or corrosive environments shall be NEMA 4X rated.

c. Operator interface terminal devices shall be suitable for use in ambient conditions from 32º Fahrenheit to 120º Fahrenheit.

d. Provide Allen-Bradley PanelView Plus 7 Performance, 10” inch diagonal screen size.

2.06 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 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 2 pairs (4 conductors). Hirschmann, N-Tron, EtherTrak, Weidmuller, or equal. Provide mounting and power circuits as required for the equipment.

B. ETHERNET / RECEPTACLE INTERFACE MODULE

1. Provide a combination Ethernet port/ 120V receptacle unit mounted with clear plastic hinged cover on the front door of each control cabinet with a PLC. Arrange the interface module such that the programmer can plug in without opening the cabinet door. Provide Grace Engineered Products, Inc. Graceport series, Automation Direct ZIPPort ZP-PSA-16-101, Lapp Systems 16-1-45CS, or equal.

C. INDICATING NUMERIC DISPLAYS

1. Loop Indicators:

a. Shall be Panel Mounted with a NEMA 4X/IP65 Sealed Front Bezel, shall have an operating ambient temperature range of at least 32° to 120° Fahrenheit, shall be suitable for use with 120 Volts Alternating Current power (unless shown otherwise), shall have an isolated 4-20 ma current loop input, shall have a ½" minimum, 4 digit minimum, LED based display showing a value in engineering units that is linearly proportional to the current loop input, shall have provisions to adjust the minimum and maximum engineering units.

b. Provide Red Lion PAX Series or equal.

2. Panel Mounted Ammeter:

a. Shall be Panel Mounted with a NEMA 12 dust-proof front bezel. Provide bezel and current transducers which display the nominal ampere for the motor between 40% and 70% of the full range. (E.g., if the motor nameplate amperes at the utilization voltage is 6 amperes, then a current meter with a range of 0-10 amperes would be acceptable.)

b. Provide Crompton Fiesta series or equal with current transducers.

3. Panel Mounted Elapsed Runtime Meter (ETM):

    a. Shall be panel mounted with a NEMA 12 dust-proof front bezel with LED backlight. The digits displayed shall be at least 0.35" high. The accumulated time shall be maintained if primary power is lost through a backup lithium ion battery.

    b. Provide Red Lion CUB7 series timer or equal.

4. Panel Mounted Start Counter (CNT):

    a. Shall be panel mounted with a NEMA 12 dust-proof front bezel with LED backlight. The digits displayed shall be at least 0.35" high. The accumulated number of starts shall be maintained if primary power is lost through a backup lithium ion battery.

    b. Provide Red Lion CUB7 series counter or equal.

2.07 PILOT DEVICES, OPERATORS, LIGHTS AND PUSHBUTTONS

A. GENERAL

1. Pilot devices (control units and stations): heavy duty, oil-tight type per NEMA ICS-1. Pilot devices shall be contained within metal housings. Provide 30-millimeter pilot devices unless otherwise indicated.

B. SELECTOR SWITCHES

1. Selector switches shall be for use on 120- or 24-volt control circuits. Contacts shall have a continuous current rating of 10 amperes both inductive and resistive. Selector switches shall be of the heavy duty oil tight type. Allen Bradley 800T, 800H, GE CR104P, Square D Type K or approved equal.

C. 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. Pushbuttons for "emergency" "help" applications shall have maintained contacts and red mushroom head operators. Allen Bradley Bulletin 800T, 800H or approved equal.

D. INDICATING LIGHTS

1. Indicating lights shall be push-to-test LED type unless otherwise noted. Illuminated pushbutton type with the pushbutton wired for the push-to-test function required. 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.

2.08 ENCLOSURES

A. EQUIPMENT CABINETS

1. Control panel enclosures shall be factory UL labeled enclosures fabricated into a rigid, self-supporting structure.

   a. Panels shall be of NEMA type construction as required for the location indicated on the Plans.

   b. Free standing panels shall be provided with channel sills unless noted otherwise.

   c. Welded construction.

   d. Completely enclosed, self-supporting, and gasketed dust-tight.

   e. Seams and corners welded and ground smooth.

   f. Provide full length piano hinges rated for 1.5 times the weight of the door and door mounted instruments.

   g. Furnish doors with keyed alike locking handles and three-point catch.

   h. Provide each panel with lifting eyebolts. Furnish stainless steel base channels.

   i. Provide slotted bolt holes in the base, 1 1/2 inches long for field adjustment.

2. Cabinet Size:

   a. The enclosure minimum size shall as shown on the drawings. With Engineer’s approval, the Integrator shall upsize the cabinet if necessary, to fit in the components.

3. Conduits shall not enter the top of exterior mounted cabinets or panels. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.

4. Enclosure shall be manufactured by Hoffman Products, Inc. or approved equal.

B. CONTROL CABINETS

1. Cabinets installed within a larger enclosure shall be NEMA 12 – powder coated steel construction.

2. Cabinets shall be hinged with stainless steel pins.

3. Cabinets shall be provided with a stainless steel 3-point latch.

4. Provide all control cabinets with a data pocket and insert the As-Built cabinet drawings enclosed within a waterproof/water-blocking envelope in the pocket when shipped to the site.
5. Provide all control cabinets which house PLC equipment with a 12x12" folding shelf HOFFMAN A-CSHELF12 or approved equal.
6. Provide corrosion inhibitors in all control cabinets prior to shipping. Amount of inhibitor shall be provided for the volume of the enclosure for one year. HOFFMAN AHC series or approved equal.
7. Enclosure shall be manufactured by Hoffman Products, Inc. or approved equal.

C. ENCLOSURE DOOR LATCHES

1. Door latches on all enclosures shall be fast operating type 3-point latch door handle.
2. NEMA 4 and 4X shall also have 3-point latch if possible, but where a 3-point latch will not meet rating requirements and also for all types of enclosures that are too small for a 3-point latch use fast operating clamp assembles. Hoffman Bulletin A-80 or equal. The latch handle shall operate toward the center of the panel to open the door and be pointing down when closed.
3. Small boxes and control stations shall have 2 screwdriver or hand operated latches.

D. ENCLOSURE HEATERS

1. Provide a fan-driven resistance heater (or as shown on plans) with 120 Volts Alternating Current. Provide separate thermostat which is adjustable between at least 40° Fahrenheit and 80° Fahrenheit; use of only thermostats integrated to the heater is not acceptable. Unless otherwise noted, provide wattage and voltage required to maintain 20 degrees above ambient at historically coldest measured temperature. Heater shall be Hoffman bulletin DAH series or approved equal.
2. Provide a 100-watt (or as shown on the plans) resistance heater with 120 Volts Alternating Current rated line thermostat in each control enclosure located outdoors or in moist environments. Provide heater with aluminum mounting plate for application in a non-metallic enclosure. Provide external heating control thermostat; use of only thermostats integrated to the heater is not acceptable. The heater shall be silicone rubber type as manufactured by WATLOW ELECTRIC, St. Louis, MO. or equal.
3. Provide heating control thermostat with adjustable heating range of at least 0 to 60° Celsius with contact ratings sufficient for connected load. Provide Hoffman Enclosures ATEM series or equal.

E. NAMEPLATES

1. Nameplates shall be phenolic with engraved lettering. Attach nameplates to enclosures with screws and glue. It is also acceptable to weld nameplate holders to the enclosure.

2.09 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 fuseholder with indicator light. Label all fuseholders 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” x 1-1/2” (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.

   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.

3. Signal power for reference voltage (for example, PLC Input Signals, VFD control circuits, and similar) shall be fast acting fuses 1/4” x 1-1/4” AGC or 13/32” x 1-1/2” Midget or CC type fuses. Fuses shall be rated at a minimum of 2 amperes. Fuses shall be manufactured by Cooper Bussmann or Littlefuse.

   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.

4. 5mm x 20mm fuses (for example, Cooper Bussmann GAS) are not acceptable for any application.

5. Provide three spare fuses of each type and size in each panel. Provide box secured to panel door interior for signal power fuses marked “SPARE FUSES”.

   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.

2.10 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 three-inch wide wireway. Wireways shall be Panduit.

2.11 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 arrestor 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 arrestor 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.

2.12 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.

2.13 POWER CONVERTERS

A. 120 VOLTS ALTERNATING CURRENT TO 24 VOLTS DIRECT CURRENT

1. Power supplies shall provide120 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.

2.14 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" by 10" (minimum) main nameplate with1 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.

2.15 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

3.01 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.

3.02 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.

3.03 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.

3.04 TERMINAL BLOCKS

A. Provide terminal strips for the termination of panel wiring not directly connected to panel mounted devices. Signals connecting to contacts of relays may use the

B. 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.

C. In general, mount terminal strips on the bottom horizontal edge of the sub-plate.

D. 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.

E. 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.

F. 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.

G. Provide terminals for individual termination of each signal shield. Locate the terminal adjacent to the terminals for the signal conductors.

3.05 PROGRAMMABLE CONTROL EQUIPMENT

A. GENERAL

1. Provide the configuration, programing, 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) Factory acceptance testing.
        2) Field loop testing.
        3) 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 Acceptance Testing

1) The entire assembled panel shall be meggered and tested to be free from grounds and shorts.

2) Circuits and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped.

3) Revise all drawings upon completion of the work to show "as shipped" condition of the panel.

d. Field Loop Testing

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.

3.06 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.

3.07 CLEANING

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.

3.08 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.

3.09 TRAINING

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. Principle of operation
2. Installation instructions
3. Description of unit and component parts
4. Operating procedures
5. Maintenance procedures
6. Safety precautions.

END OF SECTION

SECTION 40 71 13
MAGNETIC FLOW METERS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies flow meters using magnetic measurements of conductive fluids to determine flow. A flow tube and transmitter, either remote or integral to the flow tube, comprise the flow meter.

B. Provide electromagnetic full bore magnetic flow meter for permanent installations both above and below ground without the typical inlet/outlet straight pipe run mounting requirements. The full bore magnetic flowmeter shall maintain zero pressure loss while achieving 0.5% of rate accuracy even when mounted directly before or after a piping elbow, T-fitting, or insertion device. The meter shall utilize bipolar pulse DC coil excitation to measure voltage induced by the flow of conductive liquid through a magnetic flux. The voltage shall be linearly proportional to flow velocity from 0.033 to 33 feet per second.

C. Provide equipment as identified on instrument list and described in contract drawings.

Tag ID		Range	Flow Transmitter	Media
PS19-FT	Flow Meter	Standard	Integral	Wastewater
PS31-FT	Flow Meter	Standard	Remote Submersible	Wastewater

1.02 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

1.03 SUBMITTALS

A. In accordance with the requirements of Section 40 61 13, Process Control System General Provisions, submit the following project data:

1. A cover page with a table identifying each document included the submittal package.
2. A copy of the applicable specification(s) with each requirement acknowledged by checkmark or noted as a deviation where applicable. A written explanation shall be provided for each deviation from the specifications.
3. Descriptive literature including the theory of measurement.

4. Manufacturer's technical data for each specific flow meter proposed. This information shall include the following:
    a. The maximum flow rate through the proposed flow tube.
    b. The lower detection limit of the flow. In other words, report the flow rate at which or below which the instrument is not distinguishable a flow from no flow.
    c. The materials used for the wetted portions of the instrument.
    d. The power characteristics including the voltage; the frequency of power if not direct current; the peak amperage, inrush, and nominal current.
    e. The recommended circuit breaker or fuse size.
    f. The calculated error on the 4-20 mA loop based upon the flow range.
    g. Configuration and programming manual for transmitter.
5. Complete installation instructions, with points of electrical and plumbing (process) connection requirements clearly shown.
    a. If instrument or flow tube is installed within a NEC article 500 classified area (by explosive gas hazard), include the control drawing upon which the certified installation is based.
    b. Provide the adjustment factors for pumped media if different than the reference media.
    c. Minimum and maximum conductor sizes for the signal and power terminals of the transmitter and flow tube.
    d. The size and quantity of conduit knockouts or connection points for the flow tube and transmitter.

1.04 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.

C. INSTALLER QUALIFICATIONS

1. Installer shall be responsible for installing, troubleshooting, and configuring devices installed under this section.

1.05 WARRANTY

In addition to the requirements of Section 40 61 13, the flowmeter shall be commissioned by a factory certified technician so that the warranty is extended to three years from the date of shipment.

1.06 MAINTENANCE

Provide all parts necessary for maintenance and calibration purposes throughout the warranty period. Deliver all of these supplies before substantial completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store and transport flow meter in accordance with the manufacturer's instructions.

B. Provide one or more transmitters of the flow meter for shop testing unless otherwise indicated.

1.08 COORDINATION

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.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The sensor manufacturer shall be:

1. Siemens MagFlow 5000W.
2. Endress-Hauser Promag W 400.
3. Accepted equal.

B. All transmitters supplied under this division shall be from the same manufacturer and where practical shall be of the same series or model number.

2.02 GENERAL REQUIREMENTS

A. The flow meter shall be a flanged sensor (by application and instrument schedule) which complies with AWWA C751 and transmitter which may be mounted integral (compact) to the sensor or remote with interconnecting cables up to 650 feet in length.

1. The flow metering system shall be microprocessor-based and possess a non-volatile memory to store the sensor calibration and transmitter setup information. The electronics shall be interchangeable for meters sizes 1"-36".
2. The sensor shall be the proper size to measure the design flow rate of the piping and measure bi-directional flow as a standard.
3. The sensor shall consist of a stainless-steel flow tube with ANSI B16.5 or AWWA C207 carbon steel or stainless-steel flanges. The flanges shall be Class 150 for 24 inch and smaller, and AWWA Class D for 28 inch and larger (listed by the application and instrument schedule).

a. Sensors from 1”-12” shall have fixed (welded) or rotating lap joint flanges.

b. Sensors from 14”-90” shall have the flanges welded to the sensor body.

4. The sensor liner and electrode material shall be chosen to be compatible with the process fluid. All fluids require a minimum conductivity of 5µS/cm (20µS/cm for deionized water).

5. The sensor tube shall be lined with hard rubber in accordance with NSF-61 based upon the size of the flow meter and the process media conditions.

6. The sensor shall house four measuring electrodes (1”-2.5”) and six measuring electrodes (3”-12”), plus a grounding electrode, and one empty pipe detection electrode with no exceptions. The electrodes shall be bullet-nosed shaped and made of 316L SS, Alloy C22, or Tantalum (listed by the application and instrument schedule).

7. The external sensor housing shall enclose the coil assemblies and internal wiring. The materials shall be designed and constructed to prevent moisture ingress and promote corrosion resistance.

8. The electrode circuit shall have a minimum impedance of 10^{12} ohms to overcome moderate coating buildup.

9. The sensor (and flow tube) must be rated for NEMA 4X service and shall allow for temporary immersion in water depths of 10 feet for 168 hours OR 30 feet for 48 hours.

B. The transmitter shall be a three-stage microprocessor controller mounted integrally or remotely as specified in the instrument schedule. The transmitter shall incorporate a universal 100-240 VAC/18-30 VDC power supply. The transmitter housing will carry a NEMA 4X rating and shall be constructed to prevent moisture ingress, promote corrosion resistance, and be impervious to saline environments.

1. The transmitter shall allow local programming that can be operated through the enclosure window without opening the electrical enclosure.

2. The transmitter display shall indicate simultaneous flow rate and total flow with 3 totalizers (forward, reverse, and net total) and user-selectable engineering units and readout of diagnostic error messages.

3. The transmitter shall safeguard against entering of invalid data for the particular meter size and all programming parameters shall be access-code protected with a minimum requirement of dual passwords according to data sensitivity.

4. The transmitter output must be:

a. 4-20mA Analog signal proportional to flow

b. Pulse/frequency/switch capable of switching 24 volts direct current for totalizer counts.

c. Ethernet Protocol:

1) Rockwell Automation Ethernet IP (i.e., EtherNet/IP™)

2) Modicom Modbus TCP

5. The transmitter output(s) shall be integral to the magnetic flowmeter transmitter electronics. Using an external third-party signal converter is unacceptable.

6. There shall be no limitation of transmitter operational capability or diagnostic dependency between integral and compact mounting orientation.

7. The transmitter shall retain all setup parameters and accumulated measurements internally in non-volatile memory in the event of power failure. The memory unit shall be transferrable from a damaged unit or used for a duplicate device with no loss of device parameters or data stored.

8. The transmitter shall be protected against voltage spikes from the power source with internal transient protection. Power consumption must be no more than 50 VA, independent of flow tube size.

9. Device failure modes, self-monitoring characteristics and remedy diagnosis shall follow NAMUR standards NE 43 and NE 107.

10. The transmitter shall provide access to service and monitoring parameters designed to identify transient or permanent process influences.

11. The transmitter and sensor shall include a method to verify flow meter performance to the original manufacturer specifications.

    a. The system shall be traceable to factory calibration using a third party, attested onboard system pursuant to ISO standards.

    b. The verification technique shall not require external handhelds, interfaces, special tooling, or electrical access for a verification to be performed.

    c. The transmitter shall store up to eight verifications in the microprocessor.

    d. A verification of the system shall be possible at any time, locally or remotely, on demand and under process conditions.

    e. The verification report shall be compliant to common quality systems such as ISO 9000 7.6.a to prove reliability of the meter specified accuracy.

12. The transmitter shall have the following features:

    a. Unless noted otherwise, the transmitter shall be remotely mounted.

    b. Include an LCD readout for local measurement display, a 4 to 20 milliamp signal to allow operator to remotely read flow.

    c. Dry contact to for flow totalization pulse.

    d. The transmitter shall provide excitation signal to the flow tube and measure the resulting return signal from the flow tube.

    e. NEMA 4x rated.

2.03 PERFORMANCE REQUIREMENTS

A. Transmitter shall provide a signal proportional to flow where 4 milliamperes is the minimum flow and 20 milliamperes is the highest flow.

B. The overload pressure shall be at least four times the operating pressure.

C. The flow tube (sensor) must be suitable for use in a Classified area as defined by NEC Article 500.

1. Pump Station 19 – Area is not classified
2. Pump Station 31 – Area is Class I, Division 2

D. Power Requirements

1. The flow tube shall be powered and monitored from the transmitter.
2. The transmitter shall limit the current to 4-20 mA based on level with a source of 24 volts direct current.
3. The transmitter shall be powered from a 24 volts direct current power supply.

2.04 SOURCE QUALITY CONTROL & CALIBRATION

A. Magnetic flow meters shall be factory calibrated on an ISO-17025 accredited test stand per “General Requirements for the Competence of Testing and Calibration Laboratories” with certified accuracy traceable to NIST.

B. Evidence of accreditation shall originate from a national verification agency such as A2LA.

C. Each meter shall ship with a certificate of a 2-point calibration report exceeding stated standard accuracy of 0.5% of rate.

D. A real-time computer-generated printout of the actual calibration data points shall indicate apparent and actual flows. The flow calibration data shall be confirmed by the manufacturer and shipped with the meters to the project site.

E. The manufacturer shall provide complete documentation covering the traceability of all calibration instruments.

F. The manufacturer shall provide ISA data sheet ISA-TR20.00.01 as latest revision of form 20F2321. The manufacturer shall complete the form with all known data and model codes and dash out the inapplicable fields. Incomplete data sheets submitted will result in a rejected submittal.

2.05 SAFETY

A. All electrical equipment shall meet the requirements of ANSI/NFPA 70, National Electric Code latest edition.

B. All devices shall be certified for use in hazardous areas: Class 1, Div. 2, Groups B/C; temperature rating T3 (200 deg. C).

C. All devices shall be suitable for use as non-incendive devices when used with appropriate non-incendive associated equipment. Devices with intrinsically safe ratings will normally be acceptable with vendor's approval.

D. Electrical equipment housing shall conform to NEMA 4X classification.

E. Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as FM, UL, CSA, etc. for the specified electrical area classification.

F. Electrical equipment specified as intrinsically safe shall qualify as "simple apparatus" or NTRL approved intrinsically safe equipment per ANSI/ISA-RP12.6 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations," latest edition.

2.06 ACCESSORIES

A. Stainless Steel Grounding Rings from same manufacturer as flow meter flow tube unless noted otherwise.

B. Control Panel mounting kit and flow tube conductor for interconnection of flow tube and transmitter.s

2.07 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

3.01 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. Provide grounding to 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. 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.

G. Unless shown otherwise, mount remote transmitter so the center of the readout is at 60 inches above finished floor with a weather-proof snap switch enclosure arranged to disconnect power to the flow meter transmitter at 42 to 50 inches above finished floor.

H. The Contractor shall arrange the piping and installation to minimize the likelihood and effect of air bubbles in the process pipes. Where practical, the flow meter shall be on the lowest point of horizontal piping. On vertical or sloped piping, install the flowmeter such that the process flows up through the flow meter. In other words, the discharge of the flow meter is a greater elevation that the inlet of the flow meter.

3.02 FIELD QUALITY CONTROL

A. Each instrument shall be tested before commissioning and the Engineer shall witness the interface capability in the PLC control system and associated registers.

1. Each instrument shall provide direct programming capability through the PLC
2. Each instrument shall provide direct control of totalizer reset functions through the PLC
3. Each instrument shall be supported with a device profile permitting direct integration in the PLC

B. The Engineer shall witness all instrument verifications in the field.

C. Manufacturers Field Services are available for start-up and commissioning by a Factory field service representative or a manufacturer's authorized service provider (ASP) – the warranty against manufacturing defects is three years.

1. Manufacturer representative shall verify installation of all installed flow tubes and transmitters.
2. Manufacturer representative shall notify the Engineer in writing of any problems or discrepancies and proposed solutions.

3. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability, and electronics health. A comparative report shall be generated for each meter tested.

4. Manufacturer representative shall generate a configuration report for each meter.

3.03 ADJUSTING

Verify factory setup of all instruments in accordance with the Manufacturer's instructions.

3.04 PROTECTION

A. All instruments shall be fully protected after installation and before commissioning. Replace any instruments damaged before commissioning:

1. The Engineer shall be the sole party responsible for determining the corrective measures

3.05 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.

C. Configure each flowmeter to transmit the range specified and adjust the transmitter display to use the units shown above. Unless directed otherwise, configure the flow totalization pulse or dry contact to signal every 1,000 gallons.

3.06 TRAINING

Refer to Section 40 61 13, for operator training requirements.

3.07 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. Description of unit and component parts
4. Operating procedures
5. Maintenance procedures
6. Safety precautions.

END OF SECTION

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SECTION 40 72 43
PRESSURE AND DIFFERENTIAL PRESSURE TYPE LEVEL METERS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies level transmitters using pressure measurements to display fluid level.

B. Provide equipment as identified on instrument list.

Site	Tag ID		Range	Media	Connection
PS19	LT-103	Wet Well Level	0-30 Feet H_2O	Raw Sewage	Submersible
PS31	LT-103	Wet Well Level	0-30 Feet H_2O	Raw Sewage	Submersible
PS19	PT-311	Discharge Pressure	0-100 Feet H_2O	Raw Sewage	Annular Diaphragm
PS19	PT-321	Discharge Pressure	0-100 Feet H_2O	Raw Sewage	Annular Diaphragm
PS19	PT-321	Discharge Pressure	0-100 Feet H_2O	Raw Sewage	Annular Diaphragm
PS31	PT-111	Discharge Pressure	0-100 Feet H_2O	Raw Sewage	Annular Diaphragm

1.02 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

1.03 SUBMITTALS

A. In accordance with the requirements of Section 40 61 13, Process Control System General Provisions, Data Submittals, submit the following project data:

1. Descriptive literature including the theory of measurement.
2. Manufacturer's technical data for each specific level meter proposed. This information shall include the following:
   a. The maximum pressure and maximum measured pressure.
   b. The lower detection limit of the pressure. In other words, report the level at which or below which the instrument is not distinguishable a zero level.
   c. The materials used for the wetted portions of the instrument.

d. The calculated error on the 4-20 mA loop based upon the level range.

e. Configuration and programming manual for transmitter.

3. Complete installation instructions, with points of electrical and plumbing (process) connection requirements clearly shown.

a. If instrument is installed within a NEC article 500 classified area (by explosive gas hazard), include the control drawing upon which the certified installation is based.

b. Provide the adjustment factors for measured media if different than the reference media.

c. Minimum and maximum conductor sizes for the signal and power terminals of the transmitter.

d. The size and quantity of conduit knockouts or connection points for the transmitter.

1.04 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.

C. INSTALLER QUALIFICATIONS

1. Installer shall be responsible for installing, troubleshooting, and configuring devices installed under this section.

D. All metal components, anchor bolts and threaded fasteners shall be Type 316 stainless steel.

1.05 WARRANTY

A. In addition to the requirements of Section 40 61 13, transmitters shall be warranted to be free from defects in workmanship, design, and materials for a period of 24 months after substantial completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store and transport instrument in accordance with the manufacturer’s instructions.

B. Provide one or more transmitters of the meter for shop testing unless otherwise indicated.

1.07 COORDINATION

The Contractor shall 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 at no additional cost to the Owner.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The submersible level sensor manufacturer shall have sensors of this type in similar flowing mediums for a minimum of 10 years.

1. Evoqua A1000.
2. No equal.

B. The pressure transmitter manufacturer shall have sensors of this type in similar flowing mediums for a minimum of 10 years.

1. Siemens Sitrans P310,
2. Endress-Hauser Cerabar S PMP71.

C. All transmitters of similar type must be from the same manufacturer and where practical shall be the same series or model number.

2.02 GENERAL REQUIREMENTS

A. Wetted parts shall be 316 grade stainless steel. Process isolation membrane shall be Viton.

B. Unless noted otherwise, provide the following for submersible level transmitters:

1. NEMA 4X terminal box with bellows breather apparatus and desiccant holder.
2. Stainless steel cable transmitter retrieval kit with eye-loop and support hooks. It is not acceptable to use the submersible transmitter signal cord to raise and lower the transmitter.
3. Diaphragm sensing area of at least 2 inches diameter.

2.03 PERFORMANCE REQUIREMENTS

A. The accuracy of the level measurement shall be better than +/- 0.5% full measurement range.

1. Transmitters configured for level range of less than 20 feet of water pressure shall have an accuracy of +/- 0.125”.

B. Where indicated, the level sensor and associated cable shall be suitable for use in a Classified area as defined by NEC through either explosion-proof construction or through an intrinsically safe barrier or amplifier.

C. POWER REQUIREMENTS

1. The sensor shall be loop powered. With a source of +24 VDC the sensor shall limit the current to 4-20 mA based on level.

2.04 CONSTRUCTION

Process connection must be 316 stainless steel.

2.05 PRESSURE SENSOR

A. PRESSURE SENSOR RING: The pressure sensor shall consist of a full-faced, through-bolt body sealed from the sewage within the pipeline. The lining shall be suitable for sewage service. The non-wetted body shall be constructed of carbon steel. Mating flanges shall be ANSI B16.5 Class 150, Type 316 stainless steel, sized to match nominal pipe diameter shown on the Drawings.

B. PIPE FITTINGS: ¼-inch pipe fittings shall be constructed of Type 316 stainless steel and provided by the Pressure Sensor manufacturer for a complete assembly as shown on the Drawings.

2.06 ACCESSORIES

A. Provide diaphragm to isolate process fluid.

1. Provide annular process seal.

B. Provide eustachian tube equalization bag for submersible level (by pressure) transmitters.

C. Provide stainless steel retrieval kit for submersible level (by pressure) transmitters.

2.07 SPARE PARTS

A. Manufacturer’s recommended spare parts for 5 years of operation.

B. Provide one (1) additional unit of each kind of equipment listed below:

1. Submersible Level Sensor

C. Provide spare parts list and include it as part of the O&M Manual. Include manufacturer’s parts numbers and manufacturer contact information.

D. Spare equipment shall be provided in its original packaging and contain copies of installation and operation manuals.

PART 3 : EXECUTION

3.01 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. Transmitter shall be located and oriented such that the process fluid will not cause measurement errors in case of bubbles or drops.

1. Unless noted otherwise, the diaphragm seal shall be lower or arranged such that a bubble will flow away from the diaphragm membrane or seal when measuring the pressure of a liquid.
2. Unless noted otherwise, the diaphragm seal shall be higher or arranged such that a drop will flow away from the diaphragm membrane or seal when measuring the pressure of a vapor or gas.

E. 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.

F. 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.

G. 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.

3.02 MANUFACTURER'S SERVICES

Refer to Section 40 61 13, for facility startup and testing requirements.

3.03 TRAINING

Refer to Section 40 61 13, for operator training requirements.

3.04 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. Description of unit and component parts
4. Operating procedures
5. Maintenance procedures
6. Safety precautions.

END OF SECTION

SECTION 40 72 76
LEVEL SWITCHES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies level switches using fluid measurement to determine discrete level conditions.

B. Provide equipment as identified on instrument list.

Site	Tag ID	Description	Media	Type
PS19	LSL-101	Pump Stop	Wastewater	Float
PS19	LSH-102	Pump Start	Wastewater	Float
PS19	LSHH-103	High Level	Wastewater	Float
PS19	LSL-131	Pump Stop	Wastewater	Float
PS19	LSH-132	Pump Start	Wastewater	Float
PS19	LSH-393	Sump Flood	Wastewater	Float
PS19	LSL-241	Vacuum Alarm	Wastewater	Conductance
PS19	LSH-242	Vacuum Pump Start	Wastewater	Conductance
PS31	LSL-101	Pump Stop	Wastewater	Float
PS31	LSH-102	Pump Start	Wastewater	Float
PS31	LSHH-103	High Level	Wastewater	Float

1.02 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

1.03 SUBMITTALS

A. In accordance with the requirements of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following project data:

1. A cover page with a table identifying each document included the submittal package.
2. A copy of the applicable specification(s) with each requirement acknowledged by checkmark or noted as a deviation where applicable. A written explanation shall be provided for each deviation from the specifications.
3. Descriptive literature including the theory of measurement.

4. Manufacturer's technical data for each level switch type proposed. This information shall include the following:
    a. The materials used for the wetted portions of the instrument.
    b. The recommended circuit breaker or fuse size and maximum current and voltage for electrical contacts of switch.
    c. The calculated dead band, above or below the setpoint without a corresponding state change in the switch.
    d. Configuration and programming manual for transmitter as applicable.
5. Complete installation instructions, with points of electrical and plumbing (process) connection requirements clearly shown.
    a. If instrument is installed within a NEC article 500 classified area (by explosive gas hazard), include the control drawing upon which the certified installation is based.

B. OPERATION AND MAINTENANCE MANUALS

1. Refer to WSDOT Division 01 Special Provisions for Operation and Maintenance Data requirements
2. As a minimum, include the following:
    a. Principle of operation
    b. Installation instructions
    c. Description of unit and component parts
    d. Operating procedures
    e. Maintenance procedures
    f. Safety precautions.

1.04 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. Installer shall be responsible for installing, troubleshooting, and configuring devices installed under this Section.

C. All metal components, anchor bolts and threaded fasteners shall be Type 316 stainless steel.

1.05 WARRANTY

In addition to the requirements of Section 40 61 13 - Common Requirements for Process Instrumentation, transmitters shall be warranted to be free from defects in workmanship, design and materials for a period of 24 months after substantial completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store and transport instruments in accordance with the manufacturer's instructions.

B. Provide one or more transmitters of the level switch for shop testing unless otherwise indicated.

1.07 COORDINATION

The Contractor shall 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 at no additional cost to the Owner.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The mounting of the instruments shall be adjusted to signal a contact change (either within the transmitter or control panel located relay) when the measured level exceeds the monitored level.

B. CABLE FLOAT SWITCH MANUFACTURER: The float manufacturer shall have sensors of this type in similar media for a minimum of 10 years.

1. Primex Controls (SJE); KwickSwitch,
2. Dwyer,
3. Flygt,
4. Or equal.

C. CONDUCTANCE LEVEL SWITCH MANUFACTURER: The float manufacturer shall have sensors of this type in similar media for a minimum of 10 years.

1. Omega Controls
2. Siemens
3. Accepted equal

D. All transmitters supplied under this division shall be from the same manufacturer and where practical shall be the same series or model number.

2.02 PERFORMANCE REQUIREMENTS

A. The sensor shall determine if the fluid level is above both the measurement level.

1. If the level is above the measurement level, the system shall signal through a change of state on associated dry contacts.
2. Arrange contact where practical to be open when in an alarm or aberrant condition and closed otherwise.

B. The level sensor shall be suitable for use in a Classified area as defined by NEC 500 where the location in which the device is installed is classified.

C. POWER REQUIREMENTS:

1. Conductive level probes shall be powered at 24 VDC or 120 VAC nominal input power.
2. Cable float switches shall be able to switch at least 1 amperes at 120 Volts alternating current and ½ ampere at 24 Volts direct current.

2.03 CONSTRUCTION

A. CABLE FLOAT SWITCH

1. Switch shall be mercury free.
2. Float cord shall be self-supporting and rated for submergence in process fluid.

B. CONDUCTANCE LEVEL SWITCH

1. Provide with adapters as needed for connection to 1” NPT.

2.04 ACCESSORIES

A. For each float, provide at least one:

1. Provide wire mesh cord grip support as manufactured by Kellums or approved equal.
2. Provide float cord weight unless indicated otherwise.

B. For each grouping of up to four floats, provide

1. Provide float support bracket for connecting Wire Mesh cord grip support from same manufacturer as float switch.

C. For each grouping of conductance probes, provide:

1. One or more conductance sensors relays with 3A at 24VDC or 120VAC

2.05 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

3.01 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 by the Contractor 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. Wiring in hazardous locations shall meet the requirements of the NEC article 500, 501, 502, 503, 504, and 505 as applicable.

1. Ground all provide a minimum #10AWG THHN grounding conductor to any exposed metallic part unless noted otherwise.
2. Provide conduit seals where required.

F. Installation of instrumentation located in Class I, Division 1 locations shall conform to Article 504 of the NEC for Intrinsically Safe Systems. For information on wiring practices refer to the NEC and ANSI/ISA RP 12.6-1995, "Wiring Practices for Hazardous Locations Instrumentation – Part 1: Intrinsic Safety." Personnel familiar with the installation of instrumentation in hazardous areas shall perform the installation.

G. 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.

3.02 INSTALLATION

A. Provide modifications to probe lengths, if required, to achieve sensor.

B. Provide grounding or earthing bonding between process vessel and conveyance for conductance level probes.

3.03 MANUFACTURER'S SERVICES

Refer to Chapter 1-05.11 - Facility Startup, Testing and Training, for facility startup and testing requirements

3.04 TRAINING

Refer to Chapter 1-05.11 - Facility Startup, Testing and Training, for operator training requirements

END OF SECTION

SECTION 40 73 00
PRESSURE GAUGES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section Includes:

1. Instruments for pressure measurement for sewage systems.

B. Provide equipment as identified on instrument list.

	Tag ID	~~Monitored By~~*	Range
PS19	Pump 1 – Discharge Pressure	~~PLC~~	0-200 ft Aq
PS19	Pump 2 – Discharge Pressure	~~PLC~~	0-200 ft Aq
PS19	Pump 3 – Discharge Pressure	~~PLC~~	0-200 ft Aq
PS31	Pump 1 – Discharge Pressure	~~PLC~~	0-200 ft Aq
PS31	Pump 2 – Discharge Pressure	~~PLC~~	0-200 ft Aq

1.02 SUBMITTALS

A. In accordance with the provisions of Section 1-06 of the WSDOT Division 1 Special Provisions, submit the following:

1. Catalog data for performance and operation of the gauges and appurtenances.
2. Calibration certification for factory calibration of sewage pressure measurement assemblies.
3. Operation and Maintenance Data.

PART 2 : PRODUCTS

2.01 PRESSURE SENSOR

A. PRESSURE SENSOR RING: The pressure sensor shall consist of a full-faced, through-bolt body sealed from the sewage within the pipeline. The lining shall be suitable for sewage service. The non-wetted body shall be constructed of carbon steel. Mating flanges shall be ANSI B16.5 Class 150, Type 316 stainless steel, sized to match nominal pipe diameter shown on the Drawings.

B. NEEDLE VALVE: A ¼-inch needle valve shall be provided as shown on the Drawings. The valve body shall be 316 stainless steel.

C. PRESSURE GAUGE: The pressure gauge shall be a 2.5-inch diameter severe service gauge. The body shall be stainless steel. Internal components shall be stainless steel. The gauge shall be filled with glycerin. The pressure range shall be 0 to 100 psi. The connection shall be ¼-inch.

D. PIPE FITTINGS: ¼-inch pipe fittings shall be constructed of Type 316 stainless steel and provided by the Pressure Sensor manufacturer for a complete assembly as shown on the Drawings.

2.02 ACCEPTABLE MANUFACTURERS

A. Ashcroft or Red Valve Company, Inc.

1. Accessories may be by different manufacturer's, however, assembly shall be factory assembly by one supplier and shipped as one unit.

B. Accepted equal.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Install in accordance with the manufacturer's recommendations.

B. Field test assembly for accuracy.

C. Pressure sensor assemblies or gauges that fail the field test shall be removed and replaced.

END OF SECTION

SECTION 40 74 63
TEMPERATURE TRANSMITTERS

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies temperature indicating transmitters.

B. Provide equipment as identified on instrument list.

	Tag ID	Type	Monitored By	Range
PS19	Main Control Panel	Control Panel	PLC	0-60ºC
PS31	Motor Control Panel	Control Panel	PLC	0-60ºC
PS31	Main Control Panel	Control Panel	PLC	0-60ºC

C. Provide wall mounting models.

1.02 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

1.03 SUBMITTALS

A. In accordance with the requirements of Section 40 61 13, Process Control System General Provisions, submit the following project data:

1. A cover page with a table identifying each document included the submittal package.
2. A copy of the applicable specification(s) with each requirement acknowledged by checkmark or noted as a deviation where applicable. A written explanation shall be provided for each deviation from the specifications.
3. Descriptive literature.
4. Manufacturer's technical data for each specific Temperature transmitter proposed. This information shall include the following:
   a. Maximum and Minimum useful measurement temperature
   b. Maximum temperature of installed device.
5. Complete installation instructions, with points of electrical connection requirements clearly shown.

1.04 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.

C. INSTALLER QUALIFICATIONS

1. Installer shall be responsible for installing, troubleshooting, and configuring devices installed under this section.

D. All metal components, anchor bolts and threaded fasteners shall be Type 316 stainless steel.

1.05 WARRANTY

In addition to the requirements of Section 40 61 13, transmitters shall be warranted to be free from defects in workmanship, design and materials for a period of 24 months after substantial completion.

1.01 DELIVERY, STORAGE, AND HANDLING

A. Store and transport temperature transmitters in accordance with the manufacturer's instructions.

B. Provide one or more temperature transmitters for shop testing unless otherwise indicated.

1.02 COORDINATION

The Contractor shall 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 at no additional cost to the Owner.

PART 2 : PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The Wall Mounted Room Temperature sensor manufacturer shall have sensors of this type in similar flowing mediums for a minimum of 10 years.

1. Dwyer Series BTT.
2. Or approved equal.

B. The Control Panel Temperature sensor manufacturer shall have sensors of this type in similar flowing mediums for a minimum of 10 years.

1. Analog Instruments AD590.
2. Or approved equal.

C. All transmitters supplied under this division shall be from the same manufacturer and where practical shall be the same series or model number.

2.02 GENERAL REQUIREMENTS

A. Devices must use an excitation voltage of 24 volts direct current.

B. The temperature transmitter shall consist of a electrical box mounting body with resistance (RTD) temperature probe with integral 4-20 mA transmitter.

2.03 PERFORMANCE REQUIREMENTS

A. The accuracy of the level measurement shall be better than +/- 1.0 Kelvin) of measured temperature.

B. POWER REQUIREMENTS

1. The sensor shall be loop powered. With a source of +24 VDC the sensor shall limit the current to 4-20 mA based on level.

2.04 CONSTRUCTION

A. WALL MOUNTED ROOM TRANSMITTER

1. Housing must be ABS Plastic.
2. Provide NEMA 4X enclosure

B. CONTROL PANEL TEMPERATURE SENSOR

1. Ceramic package

2.05 ACCESSORIES

A. MOUNTING BRACKET

1. Provide manufacturer’s recommended bracket assembly if required to mount transmitter as shown.

B. Provide temperature element if not integral to the transmitter.

2.06 SPARE PARTS

A. Provide one (1) additional unit of each kind of equipment listed below:

1. Control panel temperature transmitter.

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

3.01 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 by the Contractor 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. Wiring in hazardous locations shall meet the requirements of the NEC. Installation of instrumentation located in Class I Division 1 locations shall conform to the requirements of Articles 500, 501, and 504 of the NEC. 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.

3.02 MANUFACTURER'S SERVICES

Refer to 40 61 13 for facility startup and testing requirements

3.03 TRAINING

Refer to 40 61 13 for operator training requirements

3.04 OPERATION AND MAINTENANCE MANUALS

A. Refer to 40 61 13 for requirements

B. As a minimum, include the following:

1. Installation instructions.
2. Description of unit and component parts.
3. Operating procedures.
4. Maintenance procedures.

END OF SECTION

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SECTION 40 76 46
PARTICULATE DETECTOR

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes: Analytical instruments for process instrumentation, auxiliary equipment, and supplies directly related to the installation of and operation of these analytical instruments, to perform the required functions in conjunction with information and equipment specified in Section 40 61 13, Process Control System General Provisions.

B. Provide equipment as identified on instrument list.

Site	Tag ID	Description	Type
PS19	PD-494	Electrical Room Particles	Area
~~PS19~~	~~PD-294~~	~~Engine Room Particles~~	~~Area~~*

1.02 SUBMITTALS

A. Shop drawings to be submitted in this section shall be made in one package. Submit material or equipment data in accordance with the requirements of 40 61 13, Process Control System General Provisions.

B. SHOP DRAWINGS

1. In addition to the requirements of Section 40 61 13, shop drawings shall include for each type of instrument: supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.

2. Furnish shop drawings for each item of mechanical equipment presenting sufficient data to determine compliance to these Specifications. Submit completed ISA S20 forms for each device and physical dimensions. Submit manufacturer's recommended location.

C. INSTALLATION METHOD: The proposed method of mounting sensors, instruments, and accessories shall accompany all shop drawings.

D. PARTS LIST: Submit a Parts List with current net prices and a list of recommended spares.

E. MANUALS: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

1.03 QUALITY ASSURANCE

A. MANUFACTURER: In addition to the requirements of 40 61 13 – Process Control System General Provisions, instruments furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.

B. MAINTAINABILITY: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments, where permitted or required herein, shall be easily accessible upon removal of a panel or cover.

C. MATERIALS AND INSTALLATION: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Drawings or specified.

1.04 DELIVERY, STORAGE, AND HANDLING

The Contractor shall be responsible for delivery, receipt, unloading, inspection of the instruments, storing, and handling the equipment.

PART 2 : PRODUCTS

2.01 GENERAL

The particulate sensor must sense high levels.

2.02 SPECIFIC REQUIREMENTS

A. Provide C-form (normally open and normally closed) contact to signal alarm.

B. Ambient temperature range shall be -40 to 60 degrees Celsius or better.

C. Sensor shall be powered by 24 VDC.

D. Monitoring shall be continuous.

E. Dry Contact, C-Form (normally open and normally closed contact from same common terminal) capable of switching at least 3 amperes at 120 Volts alternating current or 24 Volts direct current. Provide at least the following signals:

1. High Particulate Concentration Alarm; contact shall change-over when gas concentration reaches or exceeds 40% of LEL.
2. Trouble; contact shall change when the transmitter is powered off or the transmitter is unable to sense gas concentration.

2.03 CONSTRUCTION

The gas sensor shall consist the sensor head with integral monitor and transmitter in a NEMA 1 housing.

2.04 MOUNTING

Provide ceiling mounting kits.

2.05 ACCESSORIES

Provide reference gas calibration kit with adapters compatible with connector suitable for attachment to quick coupling sample port of duct mounted sampling kit.

2.06 MANUFACTURER

A. Must be manufactured by:

1. Edwards Signal,
2. Or Equal.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Testing, calibration, validation, startup, and instruction shall be in accordance with 40 61 13 – Process Control System General Provisions, and the manufacturer's instructions.

B. Install the instruments as shown on the Drawings in accordance with the Manufacturer's written installation instructions.

C. Mount the sensor on the side of the duct so dust and debris falls through the measuring space and does not gather on the mirror where shown on or indicated as being "duct" installed.

D. Mount the sensor on a wall mounted bracket within 18 inches of the structural ceiling, unless noted otherwise.

E. Keep the tubing connecting the quick coupling to the sensor head as short and straight as possible.

END OF SECTION

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SECTION 40 77 26
POSITION, SPEED, AND MOTION MEASUREMENT DEVICES

PART 1 : GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes: Motion and revolution detection devices for process equipment.

B. Provide equipment as identified on instrument list.

Site	Tag ID	Description	Type
PS 19	~~ZS-491~~ ZS-391*	Electrical Room	Door Open
PS 19	ZS-291	Valve Room	Door Open
PS 19	ZS-191	Engine Generator Room	Door Open
PS 19	ZS-192	Engine Generator Room	Door Open

C. Devices installed with control panels or equipment panels are described in those sections, but must meet the requirements of this section

1.02 SUBMITTALS

A. Shop drawings to be submitted in this section shall be made in one package. Submit material or equipment data in accordance with the requirements of Section 40 61 13 - Common Requirements for Process Instrumentation.

B. SHOP DRAWINGS:

1. In addition to the requirements of Section 40 61 13, shop drawings shall include for each type of instrument: supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.
2. Furnish shop drawings for each item of mechanical equipment presenting sufficient data to determine compliance to these Specifications. Submit completed ISA S20 forms for each device and physical dimensions. Submit manufacturer's recommended location.

C. INSTALLATION METHOD: The proposed method of mounting sensors, instruments, and accessories shall accompany all shop drawings.

D. PARTS LIST: Submit a Parts List with current net prices and a list of recommended spares.

E. MANUALS: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

1.03 QUALITY ASSURANCE

A. MANUFACTURER: In addition to the requirements of Section 40 61 13, devices furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.

B. MAINTAINABILITY: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. MATERIALS AND INSTALLATION: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Drawings or specified.

D. 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.

1.04 WARRANTY

In addition to the requirements of Section 40 61 13, transmitters shall be warranted to be free from defects in workmanship, design and materials for a period of 24 months after substantial completion.

1.05 DELIVERY, STORAGE, AND HANDLING

Store and transport transmitter in accordance with the manufacturer's instructions.

1.06 COORDINATION

The Contractor shall 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 at no additional cost to the Owner.

PART 2 : PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The body and sensor shall have the following features:

1. Sensor shall include visible position indicators, LED lights, or display for reading verification of operation and troubleshooting.

B. SPECIFIC REQUIREMENTS

1. Output shall be voltage free dry contact.

2.02 DOOR OPEN SWITCHES

A. Provide externally mounted limit switch.

1. Contact must release when door is open. Contact must be held closed by the physical door.
2. Manufacturer must be:
    a. Rockwell Automation (Allen-Bradley)
    b. Siemens Automation
    c. Schneider Electric (Square D)

2.03 MOUNTING

Mount sensors per device or equipment manufacturer's recommendation. Provide mounting brackets as required to support device and conductors to device.

2.04 CONSTRUCTION

A. The sensors for the Wet Well or other NEC 500 classified areas must be suitable for Class I, Division 1 environments.

B. The sensors installed outdoors must be NEMA 4X unless noted otherwise.

C. All other sensors may be NEMA 1 or NEMA 4X unless noted otherwise.

2.05 ACCESSORIES

Provide any handheld devices used for programming and modifying set points.

PART 3 : EXECUTION

3.01 INSTALLATION

A. Installation, testing, calibration, validation, startup, and instruction shall be in accordance with Section 40 61 13, and the manufacturer's instructions.

B. Install the instruments as shown on the Drawings.

END OF SECTION

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