

MASON COUNTY PUD NO. 1

MASON COUNTY

WASHINGTON



CONTRACT PROVISIONS

for

SHADOWOOD WATER SYSTEM IMPROVEMENTS

FUNDED THROUGH THE WASHINGTON STATE REVOLVING FUND
(DWSRF) PROGRAM WITH FEDERAL FUNDS FROM THE
ENVIRONMENTAL PROTECTION AGENCY PROJECT NO. DWL26162

G&O #21285
OCTOBER 2024



Gray & Osborne, Inc.
CONSULTING ENGINEERS

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10/4/2024

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PUBLIC NOTICE
INVITATION FOR BIDS
SHADOWOOD WATER SYSTEM IMPROVEMENTS
ENGINEER'S ESTIMATE \$2,143,000

NOTICE IS HEREBY GIVEN THAT PUBLIC UTILITY DISTRICT No. 1 OF MASON COUNTY, WA, does hereby invite bids from qualified, responsible bidders for Shadowood Water System Improvements.

SUBMISSION DEADLINE:

SEALED proposals must be received at the Mason County PUD No. 1 main office located at 21971 North Highway 101, Shelton, WA 98584, by **Tuesday, March 18, 2025 at 3:30 PM**, be addressed to "Brandy Milroy-Shadowood Water System Improvements" and include amounts for furnishing the necessary labor, materials, equipment, and tools, thereof to construct the Shadowood Reservoir, Booster Station, Iron and Manganese Treatment, and Generator. Contractors may submit the bid in person at the PUD office between 8:00 a.m. to 4:30 p.m. Monday through Friday or by mail to the PUD office. The PUD makes no guarantee that bid packages submitted by mail will arrive prior to the bid deadline. Bidding documents for the project are prepared by Gray & Osborne and are available on the PUD's website: <https://mason-pud1.org/bids/>. All bid information, including addenda will be available on this site. All addendum(s) must be signed and acknowledged and included as part of the bid packet.

BID OPENING:

A public bid opening will be held on Tuesday, March 18, 2025, at 4:00 PM PST via Zoom.

Zoom Link Info: <https://us02web.zoom.us/j/88410146007>

Proposals are to be submitted only on the form provided with the Bid Documents. All Proposals must be accompanied by a certified check, postal money order, cashier's check, or Proposal bond payable to the "Mason County PUD No. 1" and in an amount of not less than five percent (5%) of the total Proposal amount.

DISTRICT OPTION TO REJECT ALL BID PROPOSALS:

The District may, at its sole discretion, reject any or all bid proposals submitted. The District shall not be liable for any costs incurred in connection with the preparation and submittal of any bid proposal. The District reserves the right to waive any informality in a submitted proposal.

SCOPE OF WORK:

The project includes the construction of a new 90,000-gallon reinforced concrete reservoir, booster pump station, iron and manganese treatment, standby generator, site piping, site improvements, and temporary erosion and sedimentation control. An additive schedule of work includes installing installation of fencing and gates around the new reservoir and booster station site.

The Work shall be physically complete within 160 working days after the commencement date stated in the Notice to Proceed. All bidding and construction shall be performed in compliance with the Contract Provisions and Contract Plans for this project and any addenda issued thereto that are listed on the PUD's website: <https://mason-pud1.org/bids/>

For questions concerning bid documents, submittal requirements, or technical questions contact Brandy Milroy, Water Resource Manager at (360) 877-5249 or brandym@mason-pud1.org.

PREPARATION AND CONTENT OF THE PROPOSAL:

Contractor must acknowledge receipt of any addenda (if applicable). Contractor is required to bid entirety of the Proposal. **Contractors and Subcontractors must be registered and active on Sam.gov to bid on this project.**

PRE-BID JOB SHOW:

A **mandatory** pre-bid job show is scheduled for Tuesday, February 25, 2025, at 10:00 AM PST. The job show will begin at the project site at 131 SE Sunrise Dr, Shelton, WA 98584 promptly at 10:00 AM PST. Prospective bidders are required to participate. Comments and questions for the project will close on Thursday, February 27, 2025, by 4:00 PM PST.

COMPLIANCE WITH STATE & FEDERAL GRANTOR REGULATIONS:

Financing of the Project has been provided by the Washington State Drinking Water State Revolving Fund (DWSRF) program with federal funds from the Environmental Protection Agency. General contractors and all subcontractors must meet DWSRF requirements and provisions.

<https://www.doh.wa.gov/Portals/1/Documents/Pubs/331-586.pdf>

PREVAILING WAGE:

All contractors and subcontractors are required to pay Washington State prevailing wage in accordance with all applicable RCW's and Washington State laws. Contractor shall comply with all requirements concerning public works, without limitation, prevailing wage. View prevailing wage rates at <https://lni.wa.gov/licensing-permits/public-works-projects/prevailing-wage-rates/> using the published updated wage rates of February 3, 2025, which are effective March 5, 2025, or view a copy at Mason County PUD No. 1's offices at 21971 N. Hwy. 101, Shelton, WA 98584. If requested, a copy will be mailed.

"This project is subject to the 15% Apprentice Utilization Requirement (ARU), as per RCW 39.04.320 - see section 4 of the Specs for additional information".

All contractors and subcontractors are required to pay the higher Federal Wage Rate (Davis Bacon) or Washington State prevailing wages. The applicable Davis Bacon Wage Determination number is WA20250053.

DISADVANTAGED BUSINESS ENTERPRISE:

Mason County PUD No. 1 is an equal opportunity employer; small, minority and women owned firms are strongly encouraged to apply.



Brandy Milroy, Water Resource Manager

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PART 1

BID DOCUMENTS

BIDDER'S CHECKLIST

1. REQUIRED FORMS

The Bidder shall submit the following forms, which must be executed in full and submitted with the Proposal.

- a. Proposal (including Statement of Bidder's Qualifications) (Pages P-1 - P-8)
- b. Bid Deposit or Proposal Bond (PB-1)

2. SUPPLEMENTAL BIDDER CRITERIA

The Apparent two lowest bidders shall submit to the Contracting Agency the completed Supplemental Bidder Criteria forms in the Appendix by noon of the second business day following the bid submittal deadline.

3. AGREEMENT FORMS

The following forms (a., b., and c.) are to be executed and the Certificates of Insurance (d. and e.) are to be provided after the Contract is awarded and prior to Contract execution.

- a. Agreement (Pages A-1 - A-3)
- b. Performance Bond (Page B-1)
- c. Public Works Payment Bond (Page B-2)
- d. Certificate of Insurance
- e. Certificate of Builders Risk Insurance

SHADOWOOD WATER SYSTEM IMPROVEMENTS

PROPOSAL

Mason County PUD No. 1
21971 North Highway 101
Shelton, Washington 98584

The undersigned has examined the Work site(s), local conditions, the Contract, and all applicable laws and regulations covering the Work. The following unit and lump sum prices are tendered as an offer to perform the Work in accordance with all of the requirements set forth in the Contract and all applicable laws and regulations.

As required by the Contract, a postal money order, certified check, cashier's check or Proposal bond made payable to the Owner is attached hereto. If this Proposal is accepted and the undersigned fail(s) or refuse(s) to enter into a contract and furnish the required performance bond, labor and material payment bond, special guarantee bonds (if required), required insurance and all other required documentation, the undersigned will forfeit to the Owner an amount equal to five percent of the Proposal amount.

After the date and hour set for submitting the Proposals, no bidder may withdraw its Proposal, unless the Award of the contract is delayed for a period exceeding 60 consecutive calendar days.

The undersigned agrees that in the event it is Awarded the contract for the Work, it shall employ only Contractors and Subcontractors that are duly licensed by the State of Washington and remain so at all times they are in any way involved with the Work.

The undersigned agrees that the Owner reserves the right to reject any or all Proposals and to waive any minor irregularities and informalities in any Proposal.

The undersigned agrees that the Owner will Award the Contract to the lowest responsible, responsive bidder whose Proposal is in the best interest of the Owner. The Owner will determine at the time of Award of the Contract which Additive will be included in the Contract.

PROPOSAL - Continued

BASE BID:

<u>NO.</u>	<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT PRICE</u>	<u>AMOUNT</u>
1.	Mobilization and Demobilization	1 LS	\$ _____	\$ _____
2.	Minor Change	1 CALC	\$25,000.00	\$25,000.00
3.	Temporary Erosion and Sediment Control	1 LS	\$ _____	\$ _____
4.	Trench Excavation Safety Systems	1 LS	\$ _____	\$ _____
5.	Locate Existing Utilities	1 LS	\$ _____	\$ _____
6.	Unsuitable Excavation	30 CY	\$ _____	\$ _____
7.	Bank Run Gravel for Backfill	280 TN	\$ _____	\$ _____
8.	Crushed Surfacing Base Course	670 TN	\$ _____	\$ _____
9.	Crushed Surfacing Top Course	230 TN	\$ _____	\$ _____
10.	Salvage and Demolition	1 LS	\$ _____	\$ _____
11.	Sitework	1 LS	\$ _____	\$ _____
12.	Filter and Booster Pump Building	1 LS	\$ _____	\$ _____
13.	Pyrolusite Filter Equipment and Backwash Assembly	1 LS	\$ _____	\$ _____
14.	Booster Pump, 15 hp	2 EA	\$ _____	\$ _____
15.	Booster Pump, 30 hp	1 EA	\$ _____	\$ _____
16.	Wellhouse Improvements	1 EA	\$ _____	\$ _____
17.	Backwash Recycle System	1 LS	\$ _____	\$ _____
18.	Piping, Valves and Appurtenances	1 LS	\$ _____	\$ _____
19.	90,000-Gallon Concrete Reservoir, Complete	1 LS	\$ _____	\$ _____

PROPOSAL - Continued

<u>NO.</u>	<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT PRICE</u>	<u>AMOUNT</u>
20.	General and Automatic Transfer Switch	1 LS	\$ _____	\$ _____
21.	Electrical, Telemetry and Instrumentation	1 LS	\$ _____	\$ _____
22.	Restoration	1 LS	\$ _____	\$ _____
23.	Apprenticeship Incentive	1 CALC	\$2,000.00	\$2,000.00
24.	Apprenticeship Penalty	1 CALC	\$0.00	\$0.00
Subtotal (Base Bid):				\$ _____
Washington State Sales Tax (8.6%):.....				\$ _____
TOTAL CONSTRUCTION COST (BASE BID):				\$ _____

ADDITIVE ITEM 1: PERIMETER FENCING

<u>NO.</u>	<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT PRICE</u>	<u>AMOUNT</u>
1.	Site Fencing and Gates	1 LS	\$ _____	\$ _____
Subtotal (Additive 1):.....				\$ _____
Washington State Sales Tax (8.6%):.....				\$ _____
TOTAL CONSTRUCTION COST (ADDITIVE 1):.....				\$ _____

BID SUMMARY

1. TOTAL CONSTRUCTION COST
(BASE BID forwarded from above):..... \$ _____
2. TOTAL CONSTRUCTION COST
(ADDITIVE 1 forwarded from above):..... \$ _____
3. TOTAL CONSTRUCTION COST
(BASE BID AND ADDITIVE 1) \$ _____

Note: A bid must be received on all items.

PROPOSAL - Continued

STATEMENT OF BIDDER'S QUALIFICATIONS

Name of Firm: _____

Address: _____

Telephone No. _____ Fax No. _____

Contact Person for this Project: _____

E-mail: _____

Number of years the Contractor has been engaged in the construction business under the present firm name, as indicated above:

WORK TO BE COMPLETED BY BIDDER

List the Work and the dollar amount thereof that the Bidder will complete with its forces, if awarded the contract.

Work to be Performed	Dollar Amount

PROPOSAL - Continued

PROPOSED SUBCONTRACTORS (Per RCW 39.30.060)

In accordance with RCW 39.30.060, failure to list subcontractors with whom the bidder, if awarded the contract, will directly subcontract for performance of the work of structural steel installation, rebar installation, heating, ventilation and air conditioning, plumbing, as described in Chapter 18.106 RCW, and electrical, as described in Chapter 19.28 RCW or naming more than one subcontractor to perform the same work will result in your bid being non-responsive and therefore void.

These subcontractors must be listed below along with the work to be performed. This information must be provided with the Proposal or within one hour after the published bid submittal time for the work of heating, ventilation, air conditioning, plumbing and electrical. This information must be provided with the Proposal or within 48 hours after the published bid submittal time for the work of structural steel and rebar installation.

To the extent the Project includes one or more categories of work referenced in RCW 39.30.060, and no subcontractor is listed below to perform such work, the bidder certifies that the work will either (i) be performed by the bidder itself, or (ii) be performed by a lower tier subcontractor who will not contract directly with the bidder.

Subcontractor Name _____
Work to be performed _____

Subcontractor Name _____
Work to be performed _____

Subcontractor Name _____
Work to be performed _____

Subcontractor Name _____
Work to be performed _____

Subcontractor Name _____
Work to be performed _____

Bidders are notified that it is the opinion of the enforcement agency that PVC or metal conduit, junction boxes, etc., are considered electrical equipment and therefore considered part of electrical work, even if the installation is for future use and no wiring or electrical current is connected during the project.

PROPOSAL - Continued

ADDENDA RECEIVED

Addendum No.	Date Received	Name of Recipient

NOTE: Bidder shall acknowledge receipt of all addenda. Bidder is responsible for verifying the actual number of addenda issued prior to submitting a Proposal.

Subject to any extensions of the Contract Time granted under the Contract, the undersigned agrees to substantially complete the Work required under this Contract within 150 working days (the Substantial Completion Date) and to physically complete the Work required under this contract within 160 working days (the Physical Completion Date) from when Contract Time begins.

The undersigned has reviewed and fully understands the provisions in the Contract regarding liquidated damages and agrees that liquidated damages shall be \$1,500.00 per day for each and every working day beyond the Contract Time allowed for substantial completion until the Substantial Completion Date is achieved and \$500.00 for each and every working day required beyond the Contract Time for physical completion until the Physical Completion Date is achieved.

The undersigned is, and will remain in, full compliance with all Washington State administrative agency requirements including, but not limited to registration requirements of Washington State Department of Labor & Industries for contractors, including but not limited to requirements for bond, proof of insurance and annual registration fee. The undersigned's Washington State:

Dept. of Labor and Industries Workman's Compensation Account No. is _____;
Dept. of Licensing Contractor's Registration No. is _____;
Unified Business Identifier Number is _____;
Excise Tax Registration Number is _____; and
Employment Security Account Number is _____.

The undersigned has reviewed all insurance requirements contained in the Contract and has verified the availability of and the undersigned's eligibility for all required insurance. The undersigned verifies that the cost for all required insurance, has been included in this Proposal.

In relation to claims related in whole or in part to workplace injuries to employees, the undersigned waives any immunity granted under the State Industrial Insurance Law, RCW Title 51. This waiver has been specially negotiated by the parties, which is acknowledged by the undersigned in signing this Proposal.

PROPOSAL BOND

KNOW ALL MEN BY THESE PRESENTS, That we _____

of _____ as principal, and the _____

a corporation duly organized under the laws of the state of _____,
_____ and authorized to do business in the State of
Washington, as surety, are held and firmly bound unto the **MASON COUNTY PUD NO. 1** in
the full and penal sum of five percent of the total amount of the bid proposal of said principal for
the work hereinafter described, for the payment of which, well and truly to be made, we bind our
heirs, executors, administrators and assigns, and successors and assigns, firmly by these presents.

The condition of this bond is such, that whereas the principal herein is herewith
submitting his or its sealed proposal for the following construction project, to wit:

SHADOWOOD WATER SYSTEM IMPROVEMENTS

said bid and proposal, by reference thereto, being made a part hereof.

NOW, THEREFORE, If the said proposal bid by said principal be accepted, and the
contract be awarded to said principal, and if said principal shall duly make and enter into and
execute said Contract and shall furnish bond as required by the **MASON COUNTY PUD NO. 1**
within a period of 10 days from and after said award, exclusive of the day of such award, then
this obligation shall be null and void, otherwise it shall remain and be in full force and effect.

IN TESTIMONY WHEREOF, The principal and surety have caused these presents to be
signed and sealed this _____ day of _____, _____.

(Principal)

(Surety)

(Attorney-in-fact)

FUNDING AGENCY BIDDER'S CHECKLIST

BIDDER'S RESPONSIBILITY STATEMENT

It is the responsibility of each bidder to ascertain if all the documents are included in their copy of the Contract Documents.

BIDDER'S CHECKLIST

The following documents must be signed and where required, notarized, for the Bid Proposal to be complete. Unless otherwise inapplicable as noted below, all Bidders must *fill out all blanks* to be submitted at time of Bid opening.

- A. **SUBCONTRACTOR LIST:** Complete City provided form, if applicable.
- B. **NON-COLLUSION DECLARATION:** The Non-Collusion Declaration will be a part of the Bid Proposal.
- C. **BID BOND FORM:** Complete City provided form.
- D. **EQUAL BENEFITS COMPLIANCE DECLARATION:** **If the bid is over \$50,000**, complete the City provided Equal Benefits Compliance Declaration.
- E. **BID PROPOSAL:** Complete City provided form.
- F. **CERTIFICATION OF NONSEGREGATED FACILITIES:** Complete provided form.
- G. **BIDDER'S LIST:** Complete provided form.

Proposal documents shall be sealed in an envelope. The outside of the envelope shall be clearly labeled with the Project Name and Project Number, Bid opening date, time and location, and shall state in large letters: **SEALED BID – DO NOT OPEN.**

ATTACHMENT 4

NOTICE TO LABOR UNIONS OR OTHER ORGANIZATION OF WORKERS: NON-DISCRIMINATION IN EMPLOYMENT

TO: _____
(name of union or organization of worker)

The undersigned currently holds contract(s) with _____
(name of applicant)

involving funds or credit of the U.S. Government or (a) subcontract(s) with a prime contractor holding such contract(s).

You are advised that under the provisions of the above contract(s) or subcontract(s) and according to Section 202 of Executive Order 11246 dated September 24, 1965, the undersigned is obliged not to discriminate against any employee or applicant for employment because of race, color, creed, or national origin. This obligation not to discriminate in employment includes, but is not limited to, the following:

EMPLOYMENT, UPGRADING, TRANSFER OR DEMOTION

RECRUITMENT AND ADVERTISING

RATES OF PAY OR OTHER FORMS OF COMPENSATION

SELECTION FOR TRAINING INCLUDING APPRENTICESHIP, LAYOFF OR TERMINATION

This notice is furnished to you pursuant to the provisions of the above contract(s) or subcontract(s) and Executive Order 11246.

The undersigned will post copies of this notice in conspicuous places available to employees or applicants for employment.

(Contractor or Subcontractor(s))

(Date)

PART 2

AGREEMENT AND BONDS



AGREEMENT BETWEEN OWNER AND CONTRACTOR

The Effective Date of this Contract is:	
<u>The Parties to this Contract are:</u>	
The “Owner”	Mason County Public Utility District No. 1
The “Contractor”	
Project Name:	
The “Architect” or “Engineer:”	
The “Work:”	See “Scope of Work,” Exhibit <u>A</u>
Alternates included in the Contract Sum:	
Contract Sum for the Work: <i>(not including sales tax)</i>	\$
Payments: <i>(check one)</i>	<input type="checkbox"/> The Owner will make a single payment to the Contractor within thirty (30) days of Final Acceptance. <input type="checkbox"/> See Supplemental Conditions
Date of Substantial Completion of the Work:	
Date of Final Completion of the Work:	___ days after Substantial Completion
Liquidated Damages:	\$___ per day for each calendar day beyond the Contract Time that Substantial Completion is not achieved.
Owner’s Permit Responsibilities:	
Unit Prices:	
<u>Minimum Required Insurance:</u>	
Commercial General Liability:	At least \$1 million per occurrence and general aggregate.
Automobile Liability:	At least \$1 million
Workers’ Compensation (industrial insurance):	At least the State statutory amount
Employer’s Liability:	At least \$1 million
Aircraft Liability:	At least \$5 million
Watercraft Liability:	At least \$1 million
Property Insurance:	Full insurable value
Boiler and Machinery Insurance:	
Additional Insureds:	Mason County PUD No. 1

The Owner and Contractor agree as set forth below.

ARTICLE 1: THE WORK. The Contractor shall fully execute and complete the entire Work described in the Contract Documents, including the Alternates listed above.

ARTICLE 2: COMMENCEMENT AND SUBSTANTIAL AND FINAL COMPLETION.

2.1 The date of commencement of the Work is the date of this Agreement. The Contract Time is measured

from the date of commencement to the date of Substantial Completion specified above, as it may be adjusted under the Contract Documents.

2.2 The Contractor shall achieve Substantial Completion and Final Completion of the entire Work within the dates specified above, subject to adjustments of the Contract Time as provided in the Contract Documents.

ARTICLE 3: THE CONTRACT SUM. The Owner shall pay the Contractor the Contract Sum for the Contractor's performance of this Contract, subject to additions and deductions as provided in the Contract Documents. Sales tax is not included in the Contract Sum.

ARTICLE 4: PAYMENT. The Owner will pay the Contractor within *thirty (30) days* of receipt of an approved Application for Payment in accordance with this Contract. Retainage will be released in accordance with statutory requirements.

ARTICLE 5: PERMITS AND FEES.

5.1 The Owner will secure and pay for only those governmental permits, approvals, fees, licenses, inspections, governmental charges and inspection fees listed on the cover page.

5.2 The Contractor shall secure and pay for all other governmental permits, approvals, fees, licenses, inspections, governmental charges and inspection fees required for the prosecution of the Work.

ARTICLE 6: ENUMERATION OF CONTRACT DOCUMENTS.

6.1 The Contract Documents form this Contract. This Contract represents the entire and integrated agreement between the parties and supersedes prior negotiations, representations or agreements, either written or oral. The Contract Documents shall not be construed to create a contractual relationship of any kind between the Owner and a Subcontractor of any tier, between any Architect and the Contractor, or between any persons or entities other than the Owner and the Contractor.

6.2 The Contract Documents are enumerated as follows and, in the event of a conflict or discrepancy among or in the Contract Documents, interpretation shall be governed in the following order of priority:

1. Agreement
2. Prevailing wage rates set by L&I as of the bid date for Mason County (available at <http://www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/default.asp>)
3. General Conditions
4. Scope of Work (See **Exhibit A**)
5. Drawings and Specifications (Refer to Bid Package)

OWNER

By _____
(Signature)

(Printed name and title)

CONTRACTOR

By _____
(Signature)

(Printed name and title)

GENERAL CONDITIONS

ARTICLE 7 THE CONTRACT DOCUMENTS

7.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contractor's performance shall be consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

7.2 "Work" means the construction and services required by the Contract Documents and includes all labor, materials, equipment and services to be provided by the Contractor to fulfill its obligations.

7.3 If the Contractor finds a conflict, error or discrepancy in the Contract Documents, the Contractor shall report it to the Owner in writing at once. The Contractor shall not proceed with the affected Work until it receives a written interpretation or clarification from the Owner.

ARTICLE 8 ADMINISTRATION OF THE CONTRACT

8.1 The Owner will provide administration of the Contract. If an Architect or Engineer is also involved, its duties beyond those addressed in these General Conditions will be described in an attachment to this Contract.

8.2 Authority. The Owner must approve in writing all changes in the Contract Sum or Contract Time as well as all Change Orders, Construction Change Directives, and payments to the Contractor. The Owner will make any modification or release of any requirement of the Contract Documents, or any approval or acceptance of any portion of the Work, whether or not executed in accordance with the Contract Documents, exclusively in writing.

8.3 Rejection of Work. The Owner may reject Work that, in its opinion, does not conform to the Contract Documents. If the Contractor fails to correct Work that is not in accordance with the Contract Documents or fails to carry out the Work in accordance with the Contract Documents, the Owner may order the Contractor in writing to stop the Work, or any portion thereof, until the cause for that order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right.

8.4 Site Access. The Owner shall have access to and may visit the Work site at intervals it considers appropriate to the stage of the Work to become generally familiar with the progress and quality of the completed Work, but the Owner will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work.

8.5 Submittals. The Contractor shall review, approve and submit to the Owner with reasonable promptness shop drawings, product data, samples and similar submittals required by the Contract Documents. The Owner will review and approve or take other appropriate action upon the Contractor's submittals for the limited purpose of checking for conformance with information given and the design concept expressed by the Contract Documents. The Work shall be in accordance with approved submittals. The Owner's review and approval does not relieve the Contractor of responsibility for compliance with the Contract Documents. The Contractor shall submit to the Owner any proposed change to or deviation from previously approved documents or submittals.

ARTICLE 9 THE CONTRACTOR

9.1 Using its best skill and attention, the Contractor shall perform, supervise and direct the Work. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, procedures and personnel, for safety, and for coordinating all portions of the Work under this Contract. The Contractor shall provide and pay for all labor, materials, equipment, tools and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

9.2 Subcontractors. A "Subcontractor" is a person or entity that has a direct contract with the Contractor to perform a portion of the Work at the site or to supply materials or equipment. A "Subcontractor of any tier" includes Subcontractors and lower-level subcontractors and suppliers.

9.2.1 Identification. As soon as practicable and no later than *fourteen (14) days* after award of this Contract, the Contractor shall confirm to the Owner in writing the names of the Subcontractors for each portion of the Work.

9.2.2 Subcontracts. Contracts between the Contractor and Subcontractors shall require each Subcontractor to be bound to the Contractor by the terms of the Contract Documents for the Work to be performed by the Subcontractor and to assume toward the Contractor all the obligations and responsibilities that the Contractor, by the Contract Documents, assumes toward the Owner.

9.2.3 **Payment.** The Contractor shall promptly pay (and secure the discharge of any liens asserted by) all persons properly furnishing labor, equipment, materials or other items in connection with the performance of the Work for which the Owner has paid (including, but not limited to, workers and Subcontractors). The Contractor shall furnish to the Owner releases of liens and claims and other documents that the Owner requests from time to time to evidence such payment (and discharge). Nothing in the Contract Documents shall obligate the Owner to pay or to cause the payment of any moneys due to any Subcontractor of any tier or other person or entity, except as may otherwise be required by law or regulation.

9.3 **Workers.** The Contractor shall enforce strict discipline and good order among persons carrying out the Work and shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. At no change to the Contract Sum or Contract Time, the Owner may provide written notice requiring the Contractor to remove from the Work any employee or other person carrying out the Work that the Owner considers objectionable.

9.4 **Warranty.** The Contractor warrants that materials and equipment furnished under this Contract will be of good quality and new, that the Work will be performed in a workmanlike manner, free from defects not inherent in the quality required, and that the Work will conform with the requirements of the Contract Documents.

9.5 **Progress Schedule.** Within *fourteen (14) days* of execution of this Contract, the Contractor shall submit a schedule of the Work to the Owner ("Progress Schedule"). The Contractor will be responsible for planning, scheduling, managing, and reporting the progress of the Work in accordance with all of the specific methods and submittals described in the Contract Documents. The Contractor shall use the Progress Schedule (as updated) to plan, coordinate, and prosecute the Work in an orderly and expeditious manner.

9.6 **Clean-Up.** The Contractor shall keep the site and surrounding area free from accumulation of waste materials caused by operations under the Contract.

9.7 **Indemnification.**

9.7.1 Subject to the following conditions and to the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the Owner and its agents, employees, consultants, successors and assigns (together, the "Indemnified Parties") from and against all claims, damages, losses and expenses, direct and indirect, or consequential, including but not limited to costs, attorneys' fees, and other litigation expenses incurred on such claims and in proving the right to indemnification, arising out of or resulting from the performance of the Work by or any act or omission of the Contractor, its agents, any Subcontractor of any tier, and anyone directly or indirectly employed by them (together, the "Indemnitor").

.1 The Contractor will fully indemnify and defend the Indemnified Parties for the sole negligence of the Indemnitor.

.2 The Contractor will indemnify and defend the Indemnified Parties for the concurrent negligence of the Indemnitor only to the extent of the Indemnitor's negligence. The Contractor agrees to being added by the Owner as a party to any mediation, arbitration or litigation with third parties in which the Owner alleges indemnification or contribution from the Indemnitor. The Contractor agrees that all of its Subcontractors of any tier will similarly stipulate in their subcontracts. To the extent a court or arbitrator strikes any portion of this indemnification provision for any reason, all remaining provisions shall retain their vitality and effect.

9.7.2 After mutual negotiation of the parties, the indemnification obligation shall not be limited by the amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts in claims by an employee of the Contractor or a Subcontractor of any tier against any person or entity indemnified under this Paragraph 9.7. For the sole purpose of effecting the indemnification obligations under this Contract and not for the benefit of any third parties unrelated to the Owner, the Contractor specifically and expressly waives any immunity that may be granted it under Title 51 RCW, "Industrial Insurance." IF THE CONTRACTOR DOES NOT AGREE WITH THIS WAIVER, IT MUST PROVIDE A WRITTEN NOTICE TO THE OWNER PRIOR TO THE DATE FOR THE RECEIPT OF BIDS, OR THE CONTRACTOR WILL BE DEEMED TO HAVE NEGOTIATED AND WAIVED THIS IMMUNITY.

9.8 **Records.** The Contractor shall maintain and preserve books, ledgers, records, estimates, correspondence, logs, schedules, electronic data and other documents relating or pertaining to the costs and/or performance of the Contract ("records"). Within *seven (7) days* of the Owner's request, the Contractor shall make available at the Contractor's office all records for inspection, audit and reproduction (including electronic reproduction) by the Owner's representatives. These requirements apply to each Subcontractor of any tier. The Contractor agrees, on behalf of itself and Subcontractors of any tier, that the invocation of any rights under RCW 42.56 shall initiate an equivalent right to disclosures from the Contractor and Subcontractors of any tier for the benefit of the Owner.

9.9 **Compliance with Law.** The Contractor, its employees, Subcontractors of any tier and representatives, shall comply with all applicable laws, ordinances, statutes, rules and regulations, federal and state, county and municipal.

9.9.1 **Prevailing Wages.** The Contractor shall comply with all applicable provisions of RCW 39.12, including but not limited to submission of approved "Statements of Intent to Pay Prevailing Wage," payment of all Labor & Industries' fees, submission and posting of approved "Statements of Intent to Pay Prevailing Wages" and payment of prevailing wages. The State of Washington prevailing wage rates applicable for this public works project, which is located in Mason County, may be found at the following website

<https://lni.wa.gov/licensing-permits/public-works-projects/prevailing-wage-rates/> using the published updated wage rates of February 1, 2025, which are effective March 2, 2025, or view a copy at Mason County PUD No. 1's offices at 21971 N. Hwy. 101, Shelton, WA 98584. If requested, a copy will be mailed. The Contractor shall keep a paper copy at the Project site.

9.9.2 **Hours of Labor.** The Contractor shall comply with all applicable provisions of RCW 49.28.

9.9.3 **Worker's Right to Know.** The Contractor shall comply with RCW 49.70 and WAC 296-62-054 regarding workplace surveys and material safety data sheets for "hazardous" chemicals at the Project site.

ARTICLE 10 CONSTRUCTION BY THE OWNER OR BY SEPARATE CONTRACTORS

10.1 The Owner may perform construction or operations related to the Project with its own forces and may award separate contracts in connection with other portions of the Project or other construction or operations on the site under contractual conditions consistent with those of the Contract Documents.

10.2 The Contractor shall afford the Owner and separate contractors reasonable opportunity for the introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations.

ARTICLE 11 CHANGES IN THE WORK

11.1 The Owner, without invalidating this Contract, may order changes in the Work consisting of additions, deletions or modifications ("Changes"), and the Contract Sum and Contract Time will be adjusted accordingly. Changes in the Work, in the Contract Sum and/or in the Contract Time shall be authorized only by written Change Order signed by the Owner and the Contractor or by written Construction Change Directive signed by the Owner.

11.1.1 **Change Orders.** A Change Order is a written instrument signed by the Owner and the Contractor stating their agreement upon a change in the Work, the amount of any adjustment in the Contract Sum, and the extent of any adjustment in the Contract Time.

11.1.2 **Construction Change Directives.** A Construction Change Directive is a written order prepared and signed by the Owner that directs a change in the Work and states a proposed basis for any adjustment in the Contract Sum and/or Contract Time. It is used in the absence of total agreement on the terms of a Change Order. The Contractor shall promptly proceed with the change in the Work described in the Construction Change Directive. As soon as possible, and within *seven (7) days* of receipt, the Contractor shall advise the Owner in writing of the Contractor's agreement or disagreement with the cost or the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

11.2 Costs of Changes and Claims. If the parties cannot agree on the cost or credit to the Owner from a Construction Change Directive or other Change in the Work, the Contractor and all affected Subcontractors of any tier shall keep and present an itemized accounting with supporting data. The total cost of any Change or Claim shall be limited to the reasonable value of the direct labor costs, material costs, construction equipment usage costs for the actual time equipment appropriate for the Work is used solely on the Change in the Work, the cost of any change in insurance, Subcontractor costs, and a fee for all combined overhead and profit, including impact costs of any kind, limited to twelve percent (12%) of the cost for any materials or work performed by the forces of the Contractor or a Subcontractor and eight percent (8%) of amounts due to Subcontractors.

11.3 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site that are (1) concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found and generally recognized as inherent in activities of the character provided for in the Contract Documents, then the Contractor shall give written notice to the Owner promptly before conditions are disturbed and in no event later than *seven (7) days* after the first observance of the conditions. The Contractor shall make any Claim arising from such condition in accordance with the dispute resolution procedures of Article 19.

ARTICLE 12 TIME

12.1 Delay.

12.1.1 **Time.** If the Work is delayed by changes ordered in the Work, unanticipated general labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions not reasonably anticipatable, unavoidable casualties or any other causes beyond the Contractor's control, then the Contract Time shall be extended by Change Order to the extent the critical path is affected.

12.1.2 **Damages.** The Contractor and Sub-contractors shall be entitled to damages for delay only where the Owner's actions or inactions were the actual, substantial cause of the delay and where the Contractor could not have reasonably avoided the delay

by the exercise of due diligence.

12.1.3 Contractor Delay. If a delay was caused by the Contractor, a Subcontractor of any tier, or anyone acting on behalf of any of them, the Contractor is not entitled to an increase in the Contract Time or in the Contract Sum.

12.2 Completion and Liquidated Damages. The timely completion of the Project is essential to the Owner. The Owner will incur serious and substantial damages if Substantial Completion of the Work does not occur within the Contract Time. The Contractor is responsible for actual damages for delay unless an amount is inserted on the cover page for liquidated damages, in which case the liquidated damage amount shall apply. Liquidated damages shall not be affected by partial completion, occupancy, or beneficial occupancy.

ARTICLE 13 PAYMENTS AND COMPLETION

13.1 Payments. Payment shall be made as provided in this Contract, including any Supplemental Conditions.

13.2 Withheld Payment. The Owner may withhold payment in whole or in part, or it may nullify the whole or part of a payment previously issued, on account of (1) defective Work not remedied, (2) claims or liens filed by third parties, (3) failure of the Contractor to make payments due to Subcontractors or for labor, materials or equipment, (4) damage to the Owner or another contractor, (5) reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum, (6) reasonable evidence that the unpaid balance would not be adequate to cover actual or liquidated damages for delay for which the Contractor is responsible, (7) failure to carry out the Work in accordance with the Contract Documents, or (8) liquidated damages. The Owner will provide the Contractor with written notice of its intent to implement this provision and provide details supporting the Owner's intention. The Contractor will be afforded reasonable time following receipt of such notice to respond to or correct the circumstances provoking this action by the Owner.

13.3 Substantial Completion.

13.3.1 Substantial Completion is the stage in the progress of the Work when the construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can fully utilize the Work (or a designated portion) for its intended use. All Work other than incidental corrective or punchlist work and final cleaning shall have been completed. The Work is not Substantially Complete if all systems and parts affected by the Work are not usable, any required occupancy or use permit has not been issued, or if utilities affected by the Work are not connected and operating normally. The fact that the Owner may use or occupy some or all of the Work does not indicate that the Work is Substantially Complete, nor does it toll or change any liquidated damages due the Owner.

13.3.2 When the Contractor believes that the Work has achieved Substantial Completion, it shall notify the Owner in writing. When the Owner agrees, it will issue a Certificate of Substantial Completion.

13.3.3 Immediately before any occupancy, the Owner will schedule an inspection tour of the area to be occupied. Representatives of the Owner and the Contractor will jointly tour the area and record items still remaining to be finished and/or corrected. The Contractor shall promptly supply and install any such items as well as items missed by the inspection but required or necessary for Final Completion as a part of the Contract Sum.

13.4 Final Completion. After the Contractor has notified the Owner that the Work has been concluded, and the Contractor has submitted the items listed below as may be required at the discretion of the Owner, the Owner will determine in writing that Final Completion has occurred.

- .1 A final Application for Payment.
- .2 An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or its property might in any way be responsible or encumbered, have been paid or otherwise satisfied.
- .3 Consent of surety to final payment.
- .4 A certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be cancelled or allowed to expire until at least thirty (30) days' prior written notice has been given to the Owner.
- .5 A written statement that the Contractor knows of no substantial reason why the insurance will not be renewable to cover the period required by the Contract Documents.
- .6 Other data establishing payment or satisfaction of or protection (satisfactory to the Owner) against all obligations, such as receipts, releases and waivers of liens and claims.
- .7 Pursuant to RCW 39.12.040, an "Affidavit of Wages Paid" from the Contractor and from each Subcontractor certified by the Industrial Statistician of the Department of Labor and Industries, with the fees paid by the Contractor or Subcontractor.

.8 A certified statement that the Contractor has closed all necessary permits or otherwise met the requirements of all governing jurisdictions related to this Project.

.9 Pursuant to RCW 60.28.020, certificates from the Department of Revenue and the Department of Labor and Industries.

.10 Pursuant to RCW 50.24, a certificate from the Department of Employment Security.

.11 All deliverables required by the Contract Documents.

.12 A certification that the materials in the Work are "lead-free" and "asbestos free."

.13 A legible hard copy of the as-built drawings.

13.5 Final Acceptance and Final Payment.

13.5.1 Pursuant to RCW 60.28, completion of the contract Work shall occur after Final Completion has been achieved and the Owner has formally accepted the Project ("Final Acceptance"). Final Payment shall not become due until after Final Acceptance.

13.5.2 If any Subcontractor of any tier refuses to furnish a release or waiver required by the Owner, the Owner may retain an amount to defray the cost of foreclosing the liens of such claims and to pay attorneys' fees, the total of which shall be no less than one hundred fifty percent (150%) of the claimed amount. If any such lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

13.6 Waivers.

13.6.1 Final Payment by the Owner. The making of final payment constitutes a waiver of claims by the Owner except those arising from (1) liens, claims, security interests, or encumbrances arising out of the Contract and unsettled; (2) failure of the Work to comply with the requirements of the Contract Documents; (3) Work subsequently found to be substandard and/or deficient; or (4) terms of warranties required by the Contract Documents or law.

13.6.2 Final Payment to the Contractor. Acceptance of final payment by the Contractor constitutes a waiver of Claims except those previously made in writing and specifically identified as unsettled on the final Application for Payment.

13.6.3 Change Orders. The execution of a Change Order constitutes a waiver of Claims by the Contractor arising out of the Work to be performed or deleted pursuant to the Change Order, except as specifically described in the Change Order.

13.6.4 Reservation of Rights. If the Contractor adds to a Change Order, a Construction Change Directive, or any other document a reservation of rights that has not been initialed by the Owner, any amounts previously agreed shall be considered disputed and not yet payable unless the costs are re-negotiated or the reservation is withdrawn or changed in a manner satisfactory to and initialed by the Owner.

13.6.5 Failure to Exercise. The Owner's failure to exercise any of its rights under this Contract shall not constitute a waiver of any past, present or future right or remedy. Any waiver by the Owner of any right or remedy under this Contract must be in writing and shall apply only to the right or remedy specified.

13.7 Warranty of Title. The Contractor warrants and guarantees that title to the Work, materials and equipment covered by an Application for Payment, whether or not incorporated in the Project, will pass to the Owner no later than the time of payment, free and clear of liens.

ARTICLE 14 **PROTECTION OF PERSONS AND PROPERTY**

14.1 The Contractor shall be solely responsible, and the Owner shall not have responsibility, for all aspects of safety related to this Contract or the Work, including initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury or loss to, persons or property.

14.2 The Contractor shall promptly remedy to the Owner's satisfaction damage or loss to property at the site caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, except for damage or loss attributable to acts or omissions of the Owner or by anyone for whose acts the Owner may be liable that are not attributable to the fault or negligence of the Contractor or a Subcontractor of any tier.

14.3 The Contractor shall not be required to perform without consent any Work relating to asbestos or polychlorinated biphenyl, unless identified as such in the Contract Documents.

ARTICLE 15 INSURANCE AND BONDS

15.1 The Contractor shall, at its own cost, purchase from a company or companies authorized to do business in the State of Washington possessing a Best's policyholder's rating of A- or better and a financial rating of no less than VII, and reasonably acceptable to the Owner, and maintain during the life of this Contract, at least the following insurance. The Contractor shall also cause its Subcontractors of any tier to secure and maintain at least the following insurance. The insurance shall be in force at the time the Work is commenced and shall remain in force until Substantial Completion, unless a later date is specified below.

15.1.1 Contractor's Liability Insurance. The Contractor shall purchase and maintain an occurrence-based Commercial General Liability Insurance Policy and such other insurance as will provide protection from claims set forth below which may arise out of or result from Contractor's operations under the Contract Documents, whether to be performed or furnished by Contractor, by any Subcontractor, by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefits and other similar employee benefit acts, as required by the laws of the state of Washington, including Contingent Employers Liability (Stop Gap) for all employees of the Contractor and Subcontractors;

.2 If there is an exposure for injury to Contractor's or subcontractors' employees under the United States Longshoremen's and Harbor Workers' Compensation Act, the Jones Act or under laws, regulations or statutes applicable to maritime employees, or any similar laws, regulations or statutes, coverage shall be included for such injuries or claims.

.3 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees and of any person other than the Contractor's employees;

.4 Claims for damages insured by personal injury liability coverage that are sustained (a) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or (b) by any other person for any other reason.

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom;

.6 Claims arising out of operation of laws or regulations for damages because of bodily injury or death of any person or for damage to property;

.7 Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle, including coverage for Owned Motor Vehicles, Non Owned Motor Vehicles and Hired or Borrowed Motor Vehicles; and

.8 The comprehensive general liability insurance required by this paragraph must include contractual liability insurance applicable to Contractor's obligations under Paragraph 9.7.

15.1.2 Property Insurance. Unless otherwise provided in the Contract Documents, the Contractor shall purchase and maintain property insurance upon the Work at the site to the full insurable value thereof (subject to any deductible amounts that may be provided in the Contract Documents). This insurance shall include the interest in the Work of the Owner, Contractor, Subcontractors of any tier, any Architect and consultants, all of whom shall be listed as insureds or primary, non-contributing additional insured parties. Additional insured status shall be evidenced by internal policy provision or by separate external endorsement. This insurance shall insure against the perils of fire and extended coverage and shall include "all risk" insurance for physical loss and damage including, without duplication of coverage, theft, vandalism and malicious mischief, collapse, false work and water damage, temporary buildings and debris removal (including demolition occasioned by enforcement of any applicable legal requirements), and such other perils as may be provided in the Contract Documents, and shall include damages, losses and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers, architects, attorneys and other professionals). If not covered under the "all risk" insurance or otherwise provided in the Contract Documents, the Contractor shall purchase and maintain similar property insurance on portions of the Work stored on and off the site or in transit when such portions of the Work are to be included in an Application for Payment. The Owner shall bear no responsibility for such portions of the Work or the consequences of their damage or loss.

15.1.3 Boiler and Machinery Insurance. The Contractor shall purchase and maintain such boiler and machinery insurance for applicable equipment utilized or contained in the Work, which will include the interests in the Work of the Owner, Contractor, Subcontractors, any Architect, and consultants, all of whom shall be listed as insured or additional insured parties.

15.1.4 Aircraft/Watercraft Insurance. If the performance of the Work requires the use of any aircraft that are owned, leased, rented, or chartered by the Contractor or any of its Subcontractors, the Contractor shall secure and maintain Aircraft Liability Insurance for property damage and bodily injury, including passengers and crew. If the performance of the Work requires the use of any watercraft that are owned, leased, rented or chartered by the Contractor or any of its subcontractors, the Contractor shall secure and maintain Watercraft Liability insurance for property damage and bodily injury.

15.3 The Owner's specification or approval of insurance in this Contract or of its amount shall not relieve, limit or decrease the liability of the Contractor under the Contract Documents or otherwise. Coverages are the minimum to be provided and are not limitations of liability under the Contract, indemnification, or applicable law provisions. The Contractor may, at its expense, purchase larger coverage amounts or additional insurance.

15.4 Waiver of Rights

15.4.1 The Owner and Contractor waive all rights against each other for losses and damages caused by any of the perils covered by the policies of insurance provided in response to Paragraphs 15.1.2 and 15.1.3 and any other property insurance applicable to the Work, and also waive such rights against the Subcontractors, Architect, consultants and other parties named as insureds in such policies for losses and damages so caused. Each subcontract between the Contractor and a Subcontractor will contain similar waiver provisions by the Subcontractor in favor of the Owner, Contractor, Architect, consultants and all other parties named as insureds. None of these waivers shall extend to the rights that any of the insured parties may have to the proceeds of insurance held by the Owner as Trustee or otherwise payable under any policy so issued.

15.4.2 The Owner and Contractor intend that any policies provided in response to Paragraphs 15.1.2 and 15.1.3 shall protect the parties insured and provide primary coverage for losses and damages caused by the perils covered thereby. Accordingly, such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any of the parties named as insureds or additional insureds, and if the insurers require separate waiver forms to be signed by the Architect or its consultant, the Owner will obtain the same, and if such waiver forms are required of any Subcontractor, the Contractor will obtain the same.

15.5 Any insured loss under the policies of insurance required by Paragraphs 15.1.2 and 15.1.3 will be adjusted with the Owner and made payable to the Owner as Trustee for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause. The Owner shall deposit in a separate account any money so received, and shall distribute it in accordance with such agreement as the parties in interest may reach. If no agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Contract Modification or Written Amendment, or be a separate contract, at the Owner's option.

15.6 Endorsements.

15.6.1 The Owner, its officer and employees shall be named as a primary, non-contributing additional insured and coverage shall apply on a primary and non-contributory basis on such policies other than Workers' Compensation. Additional insured status shall be evidenced by internal policy provision or by separate external endorsement. Policies shall contain a provision that the Owner shall be given *thirty (30) days'* written notice by certified mail before cancellation of any insurance or reduction of the amount thereof, or any alteration, modification, restriction or material change thereto. No such cancellation, reduction, alteration, modification, restriction or material change in any policy shall relieve the Contractor of its obligation to maintain coverages in accordance with the Contract Documents.

15.6.2 All insurance policies to be maintained by the Contractor shall provide for Waiver of Subrogation in favor of the Owner.

15.6.3 All insurance policies, except Workers' Compensation, to be maintained by the Contractor shall provide Severability of Interests or Cross Liability Clause and provide that the insurance shall be primary and not excess to or contributing with any insurance or self-insurance maintained by the Owner.

15.7 Certificates evidencing that satisfactory coverage of the type and limits set forth in the Contract Documents shall be furnished to the Owner in a form acceptable to the Owner and shall contain provisions consistent with Paragraph 15.6.

15.8 Irrespective of the requirements of the Contract Documents as to insurance to be carried by the Contractor, insolvency, bankruptcy or failure of any insurance company to pay all claims accruing, shall not be held to relieve the Contractor of any of its obligations.

15.9 The Contractor shall defend, indemnify and hold the Owner harmless from any failure of the Contractor or its Subcontractors of any tier to secure and maintain insurance as required by this Contract.

**ARTICLE 16
CORRECTION OF WORK**

16.1 The Contractor shall promptly correct Work rejected or failing to conform to the requirements of the Contract Documents at any time through a period of *one (1) year* from the date of Substantial Completion of this Contract or by terms of a longer manufacturer's warranty or an applicable special warranty required by the Contract Documents.

16.2 If the Contractor fails to carry out or correct Work that is not in accordance with the Contract Documents, the Owner may, by written order, require the Contractor to stop the Work or any portions thereof until the cause for the order has been eliminated, and the Owner may take over and correct some or all of the non-conforming Work at the Contractor's cost.

16.3 Nothing in this Article shall be construed to establish a period of limitation with respect to other obligations that the Contractor might have under the Contract Documents.

ARTICLE 17 MISCELLANEOUS PROVISIONS

17.1 Applicable Law. This Contract shall be governed by the internal law of the State of Washington, without regard to its choice-of-law provisions.

17.2 Compliance with Law. The Contractor shall give notices and comply with applicable laws, rules, regulations and orders of public authorities, including but not limited to RCW 39.06 and RCW 18.27 (Registration), RCW 49.60 (Discrimination), RCW 70.92 (Aged and Handicapped Persons), WAC 296-155 (Safety Standards), RCW 50.24 (Unemployment Compensation), RCW 51 (Industrial Insurance); RCW 82 (State Excise Tax Registration), RCW 39.12.065(3) (prevailing wage violations), Drug-Free Workplace Act of 1988 (Drug-Free Workplace) and RCW 49.26 (any asbestos removal).

17.3 Assignment. The Contractor shall not let, assign or transfer this Contract, or any interest in it or part of it, without the written consent of the Owner.

17.4 The Owner's Site Rules. The Contractor shall comply with the Owner's site and conduct rules.

17.5 Survival of Clauses. The warranty, dispute resolution, and indemnification provisions of this Contract shall survive the termination, cancellation or expiration of this Contract.

17.6 Writing Required. No addition to or modification of this Contract or waiver of any provisions of this Contract shall be binding on either Party unless explicitly made in writing and executed by the Contractor and the Owner.

17.7 Safety Standards. Contractor shall comply with require adequate safety systems for the trench excavation that meet the requirements of the Washington industrial safety and health act, chapter 49.17 RCW. The Contractor shall comply with pertinent provisions of Chapter 296-155 WAC, "Safety Standards for Construction Work," including without limitation trench safety requirements of RCW 39.04.180.

ARTICLE 18 TERMINATION OF THE CONTRACT

18.1 Termination for Cause by the Contractor. If the Owner fails to make payment of undisputed amounts for a period of *sixty (60) days* through no fault of the Contractor, the Contractor may, upon *seven (7) additional days'* written notice (during which time the Owner has the right to cure), terminate the Contract and recover from the Owner payment for all Work executed in accordance with the Contract Documents.

18.2 Termination for Cause by the Owner. The Owner may, upon *seven (7) days'* written notice to the Contractor, terminate without prejudice the whole or any portion of the Work for cause, including but not limited to the Contractor's material breach of this Contract; failure to prosecute the Work or any portion thereof with sufficient diligence to ensure the Substantial Completion of the Work within the Contract Time; failure to supply a sufficient number of properly skilled workers or proper materials; material disregard of laws, ordinances, rules, regulations or orders of any public authority having jurisdiction; or being adjudged bankrupt, making a general assignment for the benefit of its creditors, or having a receiver appointed on account of the Contractor's insolvency.

18.3 Termination for Convenience by the Owner. The Owner may, at any time upon *seven (7) days'* written notice to the Contractor, terminate (without prejudice to any right or remedy of the Owner) the whole or any portion of the Work for the convenience of the Owner. The Owner shall be liable to Contractor only for the amount reasonably incurred to date and due under Article 13 for the performance of the Work terminated and other pre-approved costs, consistent with the Paragraph 11.2, necessary and reasonably incurred in connection with the termination of the Work.

18.4 Effects of Termination.

18.4.1 The total sum to be paid to the Contractor under this Article 18 shall not exceed the Contract Sum as reduced by the amount of payments otherwise made.

18.4.2 Unless the Owner directs otherwise, after receipt of a notice of termination by the Owner, the Contractor shall promptly stop Work as specified in the notice of termination; place no further orders or subcontracts, except as necessary for completion of non-terminated Work; procure cancellation of all orders and subcontracts to the extent related to the performance of terminated Work; assign to the Owner all of the right, title and interest of the Contractor under all orders and subcontracts; with the Owner's approval, settle outstanding liabilities and claims arising out of such termination of orders and subcontracts not assigned to the Owner; transfer title and deliver to the entity or entities designated by the Owner the fabricated or unfabricated parts, Work in process, partially completed supplies and equipment, materials, parts, tools, dies, jigs and other fixtures, completed Work, supplies and other material produced as part of, or acquired in connection with the performance of, the Work terminated, and the completed or partially completed plans, drawings, information and other property related to the Work; take such action as may be necessary or as directed by the Owner to preserve and protect the Work and property related to the Project in the possession of the Contractor in which the Owner has an interest; and continue performance only to the extent not terminated.

18.5 Suspension. The Owner may, at its option and at any time, suspend the Contractor's performance of some or all of the Work. The Owner will give the Contractor notice of any such suspension, including the scope of the suspension and the Owner's estimate of the duration of such suspension. During the period of suspension, the Contractor shall use its best efforts to minimize costs associated with such suspension and to protect and maintain the Work. As full compensation for any such suspension, the Contractor will be eligible for an equitable adjustment, which shall not include consequential or indirect damages. Upon receipt of the Owner's notice to resume the suspended performance, the Contractor shall immediately resume performance to the extent required in the notice.

ARTICLE 19 DISPUTE RESOLUTION

19.1 All claims, disputes and other matters in question of the Contractor, direct or indirect, arising out of, or relating to, the Contract Documents or the breach thereof ("Claims") shall be decided exclusively by the following dispute resolution procedure. Failure to comply with the requirements of this Article 19 shall constitute waiver of the Claim.

19.2 Notice of Claim. The Contractor shall submit notice of all Claims to the Owner in writing within *seven (7) days* of the event giving rise to them and shall include a reasonable description of the event and its probable effect.

19.3 Claim Submission. Within *thirty (30) days* of the effective date of submitting the notice in Paragraph 19.2, the Contractor shall provide the Owner with a written Claim that includes a clear description of the Claim, all changes in cost and in time (direct, indirect, impact, consequential, and otherwise) to which the Contractor and Subcontractors of any tier are entitled, and data supporting the Claim. No act, omission, or knowledge, actual or constructive, of the Owner or any Architect shall in any way be deemed to be a waiver of the requirement for a timely written notice and a timely written Claim unless the Owner and the Contractor sign an explicit, unequivocal written waiver.

19.4 Effective Date. Unless otherwise specified in the Contract Documents, the effective date of any notice or request given in connection with this Contract shall be the date on which it is delivered to the Owner.

19.5 Informal Resolution. The Owner will make a determination of the Claim submitted. If the Contractor disagrees with the determination and wishes to pursue the Claim further, the Contractor must, within *fourteen (14) days* of receipt of the determination, provide the Owner with a written request that a representative of the Contractor, any Architect, and the Owner meet, confer, and attempt to resolve the claim. This meeting will then take place at mutually convenient time and place within *fourteen (14) days* of the Contractor's request.

19.6 Mediation. The Contractor may not bring any litigation against the Owner unless the Claim is first subject to mediation under the Construction Industry Mediation Procedures of the American Arbitration Association ("AAA"). This requirement cannot be waived except by an explicit written waiver signed by the Owner and the Contractor. To initiate the mediation process, the Contractor shall submit a written mediation request to the Owner within thirty (30) days after the meeting undertaken in Paragraph 19.5. If the parties are unable to agree to a mediator within *thirty (30) days* after the Owner's receipt of the written request for mediation, either party may submit a request for mediation to the AAA. An officer of the Contractor and the General Manager or designee of the Owner, both having full authority to settle the Claim, must attend the mediation session. To the extent there are other parties in interest, such as Subcontractors and insurers, their representatives, with full authority to settle the Claim, shall also attend the mediation session. All unresolved Claims in the Project shall be considered at a single mediation session that shall occur prior to Final Acceptance by Owner.

19.7 Litigation. The provisions of Paragraphs 19.1, 19.2, 19.5, and 19.6 are each a condition precedent to the Contractor bringing litigation. All unresolved Claims of the Contractor shall be waived and released unless the Contractor has strictly complied with the time limits of the Contract Documents, and litigation is served and filed within *120 days* after the Date of Substantial Completion as designated in writing by the Owner. This requirement cannot be waived except by an explicit written waiver signed by the Owner and the Contractor. The pendency of mediation shall toll this filing requirement.

19.8 Maintenance of Responsibilities. The parties shall diligently carry on their respective obligations and responsibilities and

maintain the Progress Schedule during any dispute resolution proceedings, unless otherwise agreed by both parties in writing.

19.9 Waiver. The requirements of this Article 19 cannot be waived except by an explicit written waiver signed by the Owner and the Contractor. The fact that the Owner and the Contractor may continue to discuss or negotiate a Claim that has or may have been defective or untimely under the Contract Documents shall not constitute waiver of the provisions of the Contract Documents unless the Owner and Contractor sign an explicit, unequivocal written waiver approved by the Owner's Board of Commissioners.

SAMPLE

Supplemental Conditions

1. Payments will be in one lump sum, minus retained funds. The District may consider payments in increments of not less than twenty-five percent (25%) of contracted amount. The Contracting Officer will be the final arbiter to set the percentage of work completed for release of any payments.

1. **Progress Payments.** Progress payments shall be made monthly for Work that is duly approved and performed during the calendar month preceding the Application for Payment according to the following procedure.

- 1.1 **Schedule of Values.** Prior to submitting its first Application for Payment, the Contractor shall submit to the Owner a schedule of values allocating the Contract Sum to the various portions that comprise the Work. The schedule of values shall be prepared in such form and supported by such data as the Owner may require. The schedule of values shall allocate at least three percent (3%) of the original Contract Sum to that portion of the Work between Substantial Completion of the Work and Final Completion, which will be earned upon Final Completion and distributed in the final payment.

- 1.2 **Draft Application.** Within the first *seven (7) days* of each month, the Contractor shall submit to the Owner a report on the current status of the Work as compared to the Progress Schedule and a draft, itemized Application for Payment for Work performed through the prior calendar month. This shall not constitute a payment request. The Contractor, the Owner and the Architect or Engineer (if any) shall meet within the next *seven (7) days* and confer regarding the current progress of the Work and the amount of payment to which the Contractor is entitled. The Owner may request the Contractor to provide data substantiating the Contractor's right to payment, such as copies of requisitions or invoices from Subcontractors. The Contractor shall not be entitled to make a payment request, nor is any payment due the Contractor, until such data is furnished.

- 1.3 **Payment Request.** Within *seven (7) days* after the Contractor and the Owner have met and conferred regarding the draft Application for Payment and the Contractor has furnished all data requested, the Contractor may submit a payment request in the agreed-upon amount, in the form of a notarized, itemized Application for Payment for Work performed during the prior calendar month on a form supplied or approved by the Owner. Among other things, the Application shall state that prevailing wages have been paid in accordance with the pre-filed statement(s) of intent to pay prevailing wages on file with the Owner and that all payments due Subcontractors from the Owner's prior payments have been made. The Application shall constitute the Contractor's representation that (1) all payments due Subcontractors from the Owner's prior payments have been made and (2) the Work is current on the Progress Schedule, unless otherwise noted on the Application. If the Contractor believes it is entitled to payment for Work performed during the prior calendar month in addition to the agreed-upon amount, the Contractor may, within the same time period, submit to the Owner a separate written payment request specifying the exact additional amount due, the category in the schedule of values in which the payment is due, the specific Work for which the additional amount is due, and why the additional payment is due.

- 1.4 **Payments to Subcontractors.** No payment request shall include amounts the Contractor does not intend to pay to a Subcontractor. If, after making a request for payment but before paying a Subcontractor for its performance covered by the payment request, the Contractor discovers that part or all of the payment otherwise due to the Subcontractor is subject to withholding from the Subcontractor for unsatisfactory performance, the Contractor may withhold the amount as allowed under the subcontract, but it shall give the Subcontractor and the Owner written notice of the remedial actions that must be taken as soon as practicable after determining the cause for the withholding but before the due date for the Subcontractor payment, and pay the Subcontractor within *eight (8) working days* after the Subcontractor satisfactorily completes the remedial action identified in the notice.

- 1.5 **Retainage.** Pursuant to RCW 60.28, the Owner will reserve five percent (5%) from the moneys the Contractor earns on estimates during the progress of the Work, to be retained as a trust fund for the protection and payment of the claims of any person arising under this Contract and the state with respect to taxes imposed pursuant to Title 82 RCW, which may be due from the Contractor. The moneys reserved will be retained in a fund by the Owner until *forty-five (45) days* following formal acceptance of the Project by the Owner ("Final Acceptance"). The Contractor may retain payment of not more than five percent (5%) from the moneys earned by any Subcontractor.

- 1.6 Upon completion of the Work, Contractor shall submit a Request for Final Payment, Certificate and Release form and itemized invoice to the Owner for approval and payment.

Scope of Work- Exhibit A

SAMPLE

List of Drawings and Specifications- Exhibit B

SAMPLE

PUBLIC WORKS PERFORMANCE BOND
to MASON COUNTY PUD NO. 1, WA

Bond No. _____

The **MASON COUNTY PUD NO. 1**, Washington, (County) has awarded to _____ (Principal), a contract for the construction of the project designated as Shadowood Water System Improvements in Shelton, Washington (Contract), and said Principal is required under the terms of that Contract 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 (\$ _____ **amount to include sales tax**) 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 agrees to indemnify, defend, and protect the County against any claim of direct or indirect loss resulting from the failure of the Principal, its heirs, executors, administrators, successors, or assigns (or any of the employees, subcontractors, or lower tier subcontractors of the Principal) to faithfully perform the Contract.

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.

The Surety agrees to be bound by the laws of the state of Washington and subjected to the jurisdiction of the state of Washington.

PRINCIPAL

SURETY

Principal Signature _____ Date

Surety Signature _____ Date

Printed Name

Printed Name

Title

Title

Local office/agent of Surety Company:

Name _____

Telephone _____

Address _____

PUBLIC WORKS PAYMENT BOND
to MASON COUNTY PUD NO. 1, WA

Bond No. _____

The **MASON COUNTY PUD NO. 1**, Washington, (County) has awarded to _____ (Principal), a contract for the construction of the project designated as Shadowood Water System Improvements in Shelton, 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 (\$ _____ **amount to include sales tax**) 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 60.28, 39.08, and 39.12 including all workers, laborers, mechanics, subcontractors, lower tier 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 all taxes incurred on said Contract under Title 50 and 51 RCW and all taxes imposed on the Principal under Title 82 RCW; and if such payment obligations have not been fulfilled, this bond shall remain in full force and effect.

The Surety agrees to indemnify, defend, and protect the County against any claim of direct or indirect loss resulting from the failure of the Principal, its heirs, executors, administrators, successors, or assigns, (or the subcontractors or lower tier subcontractors of the Principal) to pay all laborers, mechanics, subcontractors, lower tier subcontractors material persons, and all persons who shall supply such contractor or subcontractors with provisions and supplies for the carrying on of such work.

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.

The Surety agrees to be bound by the laws of the state of Washington and subjected to the jurisdiction of the state of Washington.

PRINCIPAL

SURETY

Principal Signature

Date

Surety Signature

Date

Printed Name

Printed Name

Title

Title

Local office/agent of Surety Company:

Name _____

Telephone _____

Address _____

PART 3

**WASHINGTON STATE DEPARTMENT OF COMMERCE
DRINKING WATER STATE REVOLVING FUND (DWSRF)
INSERTS**

Attachment 7-D: Bid Spec Insert for Municipal Borrowers (Pages 54-89)

WASHINGTON STATE DEPARTMENT OF HEALTH DRINKING WATER STATE REVOLVING FUND (DWSRF)

SPECIFICATIONS INSERT MUNICIPAL

The following clauses will be incorporated into construction contracts receiving financial assistance from the Washington State Department of Health Drinking Water State Revolving Fund. In the event of conflict within the contract, these clauses shall take precedence.

Required Bid Submittals

The following submittals must be submitted with the bid proposal:

- Complete Bidders List

Compliance with State and Local Laws

The contractor shall ensure compliance with all applicable federal, state, and local laws, requirements, and ordinances as they pertain to the design, implementation, and administration of the approved project.

Civil Rights

All contracts must include and comply with the following:

Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d

No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.

Section 504 of the Rehabilitation Act of 1973, 29 U.S.C. § 794

No otherwise qualified individual with a disability in the United States shall, solely by reason of his or her disability, be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving federal financial assistance.

The Age Discrimination Act of 1975, 42 U.S.C. § 6102

No person in the United States shall, on the basis of age, be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving financial assistance.

Equal Employment Opportunity, Executive Order No. 11246 (1965)

Through a series of Executive Orders, and a decision by the Equal Employment Opportunity Commission, the federal government has established a national policy designed to battle discrimination based on race, color, sex, religion, and national origin in federal assistance programs and to enhance hiring, training, and promotion opportunities for minorities and women in construction programs financed, in part, by federal dollars.

If a contract exceeds \$10,000, the contractor shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60.

Contractor's compliance with Executive Order 11246 shall be based on implementation of the Equal Opportunity Clause, and specific affirmative active obligations required by the Standard Federal Equal Employment Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4.

Must be included in all contracts:

Equal Opportunity Clause (41 CFR part 60-1.4(b))

During the performance of this contract, the contractor agrees as follows:

1. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
2. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.
3. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

5. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
6. If the contractor doesn't comply with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further government contracts or federally assisted construction contracts according to procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
7. The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding on each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States.

Federal Equal Employment Opportunity Construction Contract Specifications

(Executive Order 11246 and 41 CFR part 60-4.3)

1. As used in these specifications:
 - a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
 - b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
 - c. "Employer identification number" means the federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
 - d. "Minority" includes:
 - i. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - ii. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - iii. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific

Islands); and

- iv. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. Whenever the contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.
3. If the contractor is participating (pursuant to 41 CFR 60–4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the plan area (including goals and timetables) shall be according to that plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the plan goals and timetables.
4. The contractor shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in geographical areas where they do not have a federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where they perform the work. Goals periodically appear in the Federal Register notice form. You can obtain such notices from any Office of Federal Contract Compliance Programs or from federal procurement contracting officers. The contractor is expected to make uniform progress in meeting its goals in each craft during the period specified.
5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the contractor's obligations under these specifications, Executive Order 11246, nor the regulations promulgated pursuant thereto.
6. To count the nonworking training hours of apprentices and trainees in meeting the goals, the contractor must employ such apprentices and trainees during the training period, and make a commitment to employ them at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.
7. The contractor shall take specific affirmative action's to ensure equal employment

opportunity. The evaluation of the contractor's compliance with these specifications shall be based on its effort to achieve maximum results from its actions. The contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

- a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities where the contractor assigns employees to work. The contractor, where possible, will assign two or more women to each construction project. The contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
- b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
- c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and the action taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the contractor may have taken.
- d. Provide immediate written notification to the director of the Federal Contract Compliance Program when the union or unions the contractor has a collective bargaining agreement with doesn't refer to the contractor, a minority person or woman sent by the contractor, or when the contractor has other information that the union referral process has impeded the contractor's efforts to meet its obligations.
- e. Develop on-the-job training opportunities or participate in training programs for the area, which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the contractor's employment needs, especially programs the Department of Labor funds or approves. The contractor shall provide notice of these programs to the sources compiled under 7b above.
- f. Disseminate the contractor's EEO policy by providing notice of the policy to unions and training programs and asking them to help the contractor meet its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper or annual report; by reviewing the policy with all management personnel and all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees that have any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific

review of these items with onsite supervisory personnel, such as superintendents or general foremen, before initiating construction work at any job site. The contractor must make and maintain a written record identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

- h. Disseminate the contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the contractor's EEO policy with other contractors and subcontractors with whom the contractor does or anticipates doing business.
 - i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
 - j. Encourage present minority and female employees to recruit other minority persons and women, and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a contractor's work force.
 - k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR part 60–3.
 - l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
 - m. Continually monitoring all personnel and employment related activities to ensure seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect. Ensure that the EEO policy and the contractor's obligations under these specifications are carried out.
 - n. Ensure that all facilities and company activities are unsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to ensure privacy between the sexes.
 - o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
 - p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the contractor's EEO policies and affirmative action obligations.
8. We encourage contractors to participate in voluntary associations, which assist in fulfilling one or more of their affirmative action obligations (7a through 7p). The efforts of a contractor association, joint contractor-union, contractor community, or other similar group

where the contractor is a member and participant, may be asserted as fulfilling one or more of its obligations under 7a through 7p of these specifications. As such, the contractor must actively participate in the group, make every effort to ensure the group has a positive impact on the employment of minorities and women in the industry, and ensure the contractor's minority and female workforce participation reflects the concrete benefits of the program. In addition, the contractor must make a good faith effort to meet individual goals and timetables and provide access to documentation that demonstrates the effectiveness of actions the group takes on the contractor's behalf. However, the contractor is obligated to comply and failure of such a group to fulfill an obligation shall not be a defense for noncompliance.

9. A single goal for minorities and a separate single goal for women were established. The contractor, however, must provide equal employment opportunity and take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the contractor may be in violation of the Executive Order if a particular group is employed in a disparate manner. For example, even if the contractor achieved a goal for women in general, it may be in violation of the Executive Order if it under utilizes a specific minority group of women.
10. The contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.
11. The contractor shall not enter into any Subcontract with any person or firm debarred from government contracts pursuant to Executive Order 11246.
12. The contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
13. The contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as the standards prescribed in paragraph 7 of these specifications, to achieve maximum results from its efforts to ensure equal employment opportunity. If the contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the director of the Federal Contract Compliance Program shall proceed according to 41 CFR 60–4.8.
14. The contractor shall designate a responsible official to monitor all employment related activity to carry out the company EEO policy, to submit reports relating to the provisions hereof as the government may require, and to keep records. Records for each employee must include the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations where the work was performed. The contractor must maintain records in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, we won't require contractors to maintain separate records.

15. Nothing herein provided shall be construed as a limitation on the application of other laws, which establish different standards of compliance, or on the application of requirements for hiring local or other area residents (those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

Reporting Requirements (EEO-1)

On or before September 30 of each year, a contractor subject to Title VII of the Civil Rights Act of 1964, as amended, that has 100 or more employees, must file an “Employer Information Report EEO-1” with the EEOC or its delegate. Instructions on how to file are on the EEOC website at <http://www.eeoc.gov/employers/eo1survey/howtofile.cfm>. The contractor shall retain a copy of the most recent report filed.

Segregated Facilities (41 CFR part 60-1.8)

The contractor must provide facilities for employees in a manner that prevents segregation on the basis of race, color, religion, sex or national origin. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensuring that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. This obligation extends to all contracts containing the equal opportunity clause regardless of the amount of the contract. The term “facilities,” as used in this section, means waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, wash rooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. Separate or single-user restrooms and necessary dressing or sleeping areas shall be provided to ensure privacy between the sexes.

a. Provision

While performing this contract, the contractor must comply with all federal and state nondiscrimination laws, including, but not limited to Chapter 49.60 RCW, Washington’s Law against Discrimination, and 42 U.S.C. 12101 et seq, the Americans with Disabilities Act. If the contractor fails or refuses to comply with any applicable nondiscrimination law, regulation, or policy, DOH may rescind, cancel, or terminate this contract in whole or in part, and declare the contractor ineligible for further contracts. The contractor shall, however, be given reasonable time to cure this noncompliance.

The contractor must also include the following terms and conditions in contracts with all contractors, subcontractors, engineers, vendors, and any other entity for work or services listed in Attachment I: Scope of Work.

“The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this Contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under U.S. Environmental Protection Agency financial agreements. If the contractor fails to carry out these requirements, it is a material breach of this contract, which may result in contract termination.

American Iron and Steel Provision

Congress passed a law January 17, 2014, that requires water systems to use U.S. steel and iron products for projects funded in part or in full by a Drinking Water State Revolving Fund (DWSRF) loan.

The act defines iron and steel products as, "...the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials."

Prohibition Statement

While the contract is in effect, the contractor and its employees may not engage in severe forms of trafficking in persons, procure a commercial sex act, or use forced labor (Section 106 of the Trafficking Victims Protection Act of 2009, as amended). The contractor shall require this prohibition statement in contracts with all contractors, subcontractors, engineers, vendors, and any other entity for work or services listed in Attachment I: Scope of Work.

If the contractor or any of its employees is determined to have violated the terms of this section, this contract may be terminated.

Prevailing Wage

The work performed under this contract is subject to the wage requirements of the Davis-Bacon Act. The contractor and subcontractors must conform to wage requirements prescribed in the federal Davis-Bacon and Related Acts. These acts require them to pay laborers and mechanics employed on contracts funded in whole or in part by SRF appropriations in excess of \$2,000, prevailing wage rates and fringe benefits for corresponding classes of laborers and mechanics employed on similar projects in the area. Attachment 1A or 1B to this specification insert, and an up-to-date wage determination **must** be included in full into **any** contract and in any subcontract in excess of \$2,000. You can find wage determinations at www.wdol.gov.

Certification Regarding Suspension, Debarment, Ineligibility or Voluntary Exclusion

1. The contractor, by signing this agreement, certifies that it is not suspended, debarred, proposed for debarment, declared ineligible or otherwise excluded from contracting with the federal government, or from receiving contracts paid for with federal funds. If the contractor is unable to certify to the statements contained in the certification, they must provide an explanation as to why they cannot.
2. The contractor shall provide immediate written notice to DOH if at any time it learns that its certification was erroneous when submitted or became erroneous due to changed circumstances.
3. The terms covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded, as used in this clause, have the meaning set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may ask DOH

for help obtaining a copy of those regulations.

4. The contractor agrees it shall not knowingly enter into any lower tier covered transaction with a person proposed for debarment under the applicable Code of Federal Regulations, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction.
5. The contractor further agrees by signing this agreement, that it will include the clause titled, "Certification Regarding Suspension, Debarment, Ineligibility Or Voluntary Exclusion," without modification in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
6. Pursuant to 2CFR180.330, the contractor must ensure that any lower tier covered transaction complies with certification of suspension and debarment requirements.
7. The contractor acknowledges that failing to disclose the information required in the Code of Federal Regulations may result in the delay or negation of this funding agreement, or cause DOH to pursue legal remedies, including suspension and debarment.
8. The contractor agrees to keep proof in its agreement file, that it, and all lower tier recipients or contractors, are not suspended or debarred, and will make this proof available to the DOH on request. The recipient or contractor must run a search in www.sam.gov and print a copy of completed searches to document proof of compliance.

This term and condition supersedes EPA Form 5700-49, "Certification Regarding Debarment, Suspension, and Other Responsibility Matters."

Disadvantaged Business Enterprises (Temporarily suspended)

Small, minority and women-owned firms should be afforded the maximum opportunity to compete for and obtain bid documents for DWSRF-funded projects. The level of participation by small, minority and women-owned firms should be consistent with their general availability within the professional community involved.

General Compliance (40 CFR Part 33).

The contractor shall comply with the requirements of the U.S. Environmental Protection Agency's Program for Participation by Disadvantaged Business Enterprises (DBE) 40 CFR Part 33.

Non-discrimination Provision (40CFR Appendix A to Part 33).

The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. The contractor's failure to carry out these requirements is a material breach of this contract, which may result in contract termination or other legally available remedies.

The contractor shall comply with all federal and state nondiscrimination laws, including, but not limited to Title VI and VII of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, and

Chapter 49.60 RCW, Washington’s Law Against Discrimination, and 42 U.S.C. 12101 et seq, the Americans with Disabilities Act (ADA).

Six Good Faith Efforts (40 CFR Part 33 Subpart C).

The contractor agrees to make the following good faith efforts whenever procuring subcontracts, equipment, services and supplies. The contractor shall retain records documenting compliance with the following six good faith efforts.

1. Ensuring Disadvantaged Business Enterprises are made aware of contracting opportunities to the full extent practicable through outreach and recruitment activities. For tribal, state and local and government recipients, this will include placing Disadvantaged Business Enterprises on solicitation lists and soliciting them whenever they are potential sources. You can find Qualified Women and Minority business enterprises online at www.omwbe.wa.gov or by contacting the Washington State Office of Minority and Women’s Enterprises at 360-704-1181.
2. Making information on forthcoming opportunities available to Disadvantaged Business Enterprises and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by Disadvantaged Business Enterprises in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for at least 30 calendar days before the bid or proposal closing date.
3. Considering in the contracting process whether firms competing for large contracts could subcontract with Disadvantaged Business Enterprises. For tribal, state and local government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by Disadvantaged Business Enterprises in the competitive process.
4. Encourage contracting with a consortium of Disadvantaged Business Enterprises when a contract is too large for one of these firms to handle individually.
5. Using services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce.
6. If the prime contractor awards subcontracts, requiring the subcontractors to take the six good faith efforts in paragraphs 1 through 5 above.

Fair Share Objective Goal (40 CFR Part 33 Subpart D).

A fair share objective is a goal based on the capacity and availability of qualified, certified Minority Business Enterprises (MBEs) and Women’s Business Enterprises (WBEs) in the relevant geographic market. As mandated by EPA, all general contractors and subcontractors must comply with the requirements of the EPA’s Program for Utilization of Small, Minority, and Women’s Business Enterprises (40 CFR, Part 33) in procurement under the DWSRF program. The goals for the utilization of disadvantaged businesses are as follows:

Construction	10% MBE	6% WBE
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Supplies	8% MBE	4% WBE
Equipment	8% MBE	4% WBE
Purchased Services	10% MBE	4% WBE

All general contractors and subcontractors must accept the fair share objective/goals stated above and attest to the fact they are purchasing the same or similar construction, supplies, services, and equipment, in the same or similar relevant geographic buying market as the Washington Office of Minority Women Business goals.

The DWSRF program exempts borrowers that receive a total of \$250,000 or less in EPA funds in a given fiscal year from the Fair Share Objective requirements.

IMPORTANT: Only MBEs and WBEs certified by EPA, SBA, DOT, or by state, local, tribal or private entities whose certification criteria match EPA's can be counted towards the MBEs and WBEs utilization goal.

MBE/WBE Reporting (40 CFR Part 33 Parts 33.302, 33.502 and 33.503). (suspended)

The contractor shall provide EPA Form 6100-2 DBE Subcontractor Participation Form to all DBE subcontractors. Subcontractors may submit EPA Form 6100-2 Subcontractor Participation Form to the EPA Region 10 DBE coordinator in order to document issues or concerns with their usage or payment for a subcontract. The contractor shall require all DBE subcontractors to complete EPA Form 6100-3 DBE Subcontractor Performance Form. The contractor shall complete EPA Form 6100-4 DBE Subcontractor Utilization Form.

The contractor shall submit EPA Form 6100-4 and all completed EPA Form 6100-3 forms with the bid proposal.

Bidders List (40 CFR Part 33 part 33.501)

All bidders shall submit the following information for all firms that bid or quote on subcontracts (including both DBE and non-DBE firms) with their bid proposal.

1. Entity's name with point of contact;
2. Entity's mailing address, telephone number, and e-mail address;
3. The procurement on which the entity bid or quoted, and when; and,
4. Entity's status as an MBE/WBE or non-MBE/WBE

Contract Administration Provisions (40 CFR part 33.302).

The contractor shall comply with the contract administration provisions of 40 CFR, Part33.302.

1. The contractor shall pay its subcontractor for satisfactory performance no more than 30 days from the contractor's receipt of payment.
2. The contractor shall notify the owner in writing prior to any termination of a DBE subcontractor.

3. If a DBE subcontractor fails to complete work under the subcontract for any reason, the contractor shall employ the six good faith efforts when soliciting a replacement subcontractor.
4. The contractor shall employ the six good faith efforts even if the contractor has achieved its fair share objectives.

Third Party Beneficiary

The Washington State Department of Health Drinking Water State Revolving Fund is providing partial funding for this project. All parties agree that Washington State shall be, and is hereby, named as an express third-party beneficiary of this contract, with full rights as such.

Access to the Construction Site and to Records

The contractor shall provide Washington State Department of Health and U.S. Environmental Protection Agency personnel safe access to the construction site and to the contractor's records.

The contractor shall maintain accurate records and accounts to facilitate the owner's audit requirements and shall ensure that all subcontractors maintain auditable records.

These project records shall be separate and distinct from the contractor's other records and accounts.

All such records shall be available to the owner and to Washington State Department of Health and EPA personnel for examination. The contractor must retain all records pertinent to this project for three years after the final audit.

Attachments:

1. Wage Rate Requirements for Subrecipients
 - a. Attachment 1A for municipal borrowers
2. Current Wage Rate Determination (Verified by Contract Manager)
3. Certification Of Non-segregated Facilities
4. Notice To Labor Unions Or Other Organization Of Workers: Non-Discrimination In Employment
5. American Iron and Steel Requirements – The Use of American Iron and Steel

WAGE RATE REQUIREMENTS FOR SUBRECIPIENTS

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon Act responsibilities when the act applies to EPA awards of financial assistance with respect to government recipients and subrecipients. If a subrecipient has questions about when the act applies, how to obtain correct wage determinations, act provisions, or compliance monitoring, it may contact DOH.

1. Applicability of the Davis-Bacon (DB) prevailing wage requirements

Under the FY 2013 Continuing Resolution, Davis-Bacon prevailing wage requirements apply to construction, alteration, and repair of treatment works carried out in whole or in part with assistance from a state water pollution control revolving fund and to any construction project carried out in whole or in part by assistance from a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the state recipient before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Before issuing requests for bids, proposals, quotes or other methods for soliciting contracts, subrecipients shall obtain the wage determination for the locality where a covered activity subject to DB will take place. Subrecipients must submit the wage determination to Department of Health before inserting it into a solicitation or contract, or issuing task orders, work assignments or similar instruments to existing contractors unless the state recipient provides other directions. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring subcontractors to follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipient shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days before the closing date, the subrecipient may ask the state recipient whether there is reasonable time to notify interested contractors of the modified wage determination. The state recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days after closing the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the state recipient obtains, at the subrecipient's request, an extension of the 90 day period from DOL (29 CFR 1.6(c)(3)(iv)). The subrecipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB that prime contractors enter into to verify that the prime contractor required its subcontractors to include the applicable wage determinations.

(d) If DOL determines that the subrecipient failed to incorporate a wage determination or used a wage determination that clearly doesn't apply to the contract or ordering instrument, it may issue a revised wage determination after the subrecipient awarded the contract or issued an ordering instrument (29 CFR 1.6(f)). If this occurs, the subrecipient must either

terminate and issue a revised contract or ordering instrument, or use a change order to incorporate DOL's wage determination into the contract or ordering instrument retroactive to the beginning. . The subrecipient must compensate its contractor for any wage increases resulting from DOL's revised wage determination.

ATTACHMENT 1A

LABOR STANDARDS PROVISIONS

MUNICIPAL BORROWERS

Contract and Subcontract provisions.

(a) The recipient must ensure that subrecipient(s) insert the following clauses in full in any contract in excess of \$2,000 entered for the actual construction, alteration or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from federal funds, or according to guarantees of a federal agency or financed from funds obtained by pledge of any contract of a federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2013 Continuing Resolution:

(1) Minimum wages.

- (i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor at www.dol.gov.

- (ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The state award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:
 - (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
 - (2) The classification is utilized in the area by the construction industry; and
 - (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
 - (B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient(s) to the state award official. The state award official will transmit the request, to the administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the state award official or will notify the state award official within the 30-day period that additional time is necessary.
 - (C) If the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.
 - (D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.
- (iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

- (iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.
- (2) Withholding. The subrecipient(s), shall upon written request of the EPA award official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.
- (3) Payrolls and basic records.
- (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b) (2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.
 - (ii) (A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the state capitalization grant recipient. Such

documentation shall be available on request of the state recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the state indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division website at <http://www.dol.gov/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the state or EPA if requested by the EPA, the state, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

- (B) Each payroll submitted shall be accompanied by a "Statement of Compliance" signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:
- (1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;
 - (2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;
 - (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.
- (C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

- (D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.
- (iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the state, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the federal agency or state may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.
- (4) Apprentices and trainees.
- (i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a state Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a state Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. If the Office of Apprenticeship Training,

Employer and Labor Services, or a state Apprenticeship Agency it recognizes, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

- (ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits according to the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. IF the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.
 - (iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.
- (5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.
 - (6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.
 - (7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

- (8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.
- (9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), state, EPA, the U.S. Department of Labor, or the employees or their representatives.
- (10) Certification of eligibility.
 - (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).
 - (ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).
 - (iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of \$100,000.

- (a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.
 - (1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.
 - (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in

violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

- (3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA award official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.
 - (4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.
- (b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

- (a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must

use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

- (b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB.

Subrecipients shall, "immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence."

- (c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.
- (d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.
- (e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/contacts/whd/america2.htm>.

ATTACHMENT 2
FEDERAL & STATE WAGE RATE DETERMINATIONS

"General Decision Number: WA20250053 01/03/2025

Superseded General Decision Number: WA20240053

State: Washington

Construction Type: Heavy
including water and sewer line construction

County: Mason County in Washington.

HEAVY CONSTRUCTION PROJECTS (including sewer/water construction).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

<p>If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
<p>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number Publication Date
0 01/03/2025

CARP0030-001 06/01/2021

	Rates	Fringes
CARPENTER.....	\$ 49.18	19.01

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - ALL CLASSIFICATIONS EXCEPT MILLWRIGHTS AND PILEDRIVERS

Hourly Zone Pay shall be paid on jobs located outside of the free zone computed from the city center of the following listed cities:

Seattle	Olympia	Bellingham
Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

Zone Pay:

0 -25 radius miles	Free
26-35 radius miles	\$1.00/hour
36-45 radius miles	\$1.15/hour
46-55 radius miles	\$1.35/hour
Over 55 radius miles	\$1.55/hour

(HOURLY ZONE PAY: WESTERN AND CENTRAL WASHINGTON - MILLWRIGHT AND PILEDRIVER ONLY)

Hourly Zone Pay shall be computed from Seattle Union Hall, Tacoma City center, and Everett City center

Zone Pay:

0 -25 radius miles	Free
26-45 radius miles	\$.70/hour
Over 45 radius miles	\$1.50/hour

ELEC0076-005 02/02/2024

	Rates	Fringes
ELECTRICIAN.....	\$ 58.53	25.47

ENGI0302-001 06/01/2023

	Rates	Fringes
Power equipment operators:		
Group 1A.....	\$ 54.93	25.57
Group 1AA.....	\$ 55.75	25.57
Group 1AAA.....	\$ 56.54	25.57
Group 1.....	\$ 54.13	25.57
Group 2.....	\$ 53.42	25.57
Group 3.....	\$ 52.83	25.57
Group 4.....	\$ 49.40	25.57

Zone Differential (Add to Zone 1 rates):

Zone 2 (26-45 radius miles) -	\$1.00
Zone 3 (Over 45 radius miles) -	\$1.30

BASEPOINTS: Aberdeen, Bellingham, Bremerton, Everett, Kent,

Mount Vernon, Port Angeles, Port Townsend, Seattle, Shelton, Wenatchee, Yakima

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1AAA - Cranes-over 300 tons, or 300 ft of boom (including jib with attachments)

GROUP 1AA - Cranes 200 to 300 tons, or 250 ft of boom (including jib with attachments); Tower crane over 175 ft in height, base to boom; Excavator/Trackhoe, Backhoes: Over 90 metric tons

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; excavator/Trackhoe, backhoes: over 50 metric tons to 90 metric tons

GROUP 1 - Cranes 45 tons thru 99 tons, under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work;; Excavator/Trackhoe, backhoes: over 30 metric tons to 50 metric tons; Loader- overhead 6 yards to, but not including 8 yards; Dozer D-10

GROUP 2 - Cranes, 20 tons thru 44 tons with attachments; Crane-overhead, bridge type-20 tons through 44 tons;; Excavator/Trackhoe, backhoe: 15 to 30 metric tons; Loaders-overhead under 6 yards; Mechanic; Drilling Machine; Grader (finishing)

GROUP 3 - Cranes-thru 19 tons with attachments; A-frame crane over 10 tons;; Dozers-D-9 and under; Roller-Plant Mix; Excavator/Trackhoe, backhoe: under 15 metric tons; Forklift: 3000 lbs and over with attachments; Oiler; Grader (non-finishing);Boom Truck over 10 tons

GROUP 4 - Cranes-A frame-10 tons and under; Roller-other than plant mix; Forklift: under 3000 lbs with attachments; Boom Truck 10 tons and under

IRON0086-012 01/01/2024

	Rates	Fringes
Ironworker (REINFORCING & STRUCTURAL).....	\$ 53.45	34.02

LAB00252-002 06/02/2022

ZONE 1:

	Rates	Fringes
LABORER		
GROUP 2A.....	\$ 34.20	13.80
GROUP 3.....	\$ 42.86	13.80
GROUP 4.....	\$ 43.90	13.80
GROUP 5.....	\$ 44.62	13.80

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
ZONE 2 - \$1.00

ZONE 3 - \$1.30

BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT, TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT. TOWNSEND, PT. ANGELES, AND BREMERTON

ZONE 1 - Projects within 25 radius miles of the respective city hall

ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall

ZONE 3 - More than 45 radius miles from the respective city hall

LABORERS CLASSIFICATIONS

GROUP 2A: Flagger

GROUP 3: General or Common Laborer; Chipping Guns (Under 30 lbs)

GROUP 4: Chipping Guns (Over 30 lbs); Groutmen; Pipe Layer

GROUP 5: Mason Tender-Brick; Mason Tender-Cement/Concrete; Grade Checker

PAIN0005-008 07/01/2024

	Rates	Fringes
PAINTER (Brush, Roller and Spray).....	\$ 34.44	10.66

PLAS0528-004 06/01/2023

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 52.10	20.27

SUWA2009-044 08/07/2009

	Rates	Fringes
LABORER: Landscape.....	\$ 14.67 **	0.00
PIPEFITTER.....	\$ 30.00	8.35
TRUCK DRIVER: Water Truck.....	\$ 24.36	8.30
TRUCK DRIVER: 10 Yard Truck.....	\$ 24.61	8.34

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.75) or 13658 (\$13.30). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number

used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys

Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

ATTACHMENT 3

CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to federally assisted construction contracts and related subcontracts exceeding \$10,000, which are not exempt from the Equal Opportunity clause.)

The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor certified, further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract.

As used in this certification, the term "segregated facilities" means any waiting rooms, work area, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or area, in fact, segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed contractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such, certification in this file.

Signature

Date

Name and title of signer (please type)

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

ATTACHMENT 4

NOTICE TO LABOR UNIONS OR OTHER ORGANIZATION OF WORKERS: NON-DISCRIMINATION IN EMPLOYMENT

TO: _____
(name of union or organization of worker)

The undersigned currently holds contract(s) with _____
(name of applicant)

involving funds or credit of the U.S. Government or (a) subcontract(s) with a prime contractor holding such contract(s).

You are advised that under the provisions of the above contract(s) or subcontract(s) and according to Section 202 of Executive Order 11246 dated September 24, 1965, the undersigned is obliged not to discriminate against any employee or applicant for employment because of race, color, creed, or national origin. This obligation not to discriminate in employment includes, but is not limited to, the following:

EMPLOYMENT, UPGRADING, TRANSFER OR DEMOTION

RECRUITMENT AND ADVERTISING

RATES OF PAY OR OTHER FORMS OF COMPENSATION

SELECTION FOR TRAINING INCLUDING APPRENTICESHIP, LAYOFF OR TERMINATION

This notice is furnished to you pursuant to the provisions of the above contract(s) or subcontract(s) and Executive Order 11246.

The undersigned will post copies of this notice in conspicuous places available to employees or applicants for employment.

(Contractor or Subcontractor(s))

(Date)

ATTACHMENT 5

AMERICAN IRON AND STEEL PROVISION

USE OF AMERICAN IRON AND STEEL

MUST BE INCLUDED IN ALL CONTRACTS (PRIME AND SUB-CONTRACTORS):

This provision applies to projects for the construction, alteration, maintenance, or repair of a public water system as defined in the Safe Drinking Water Act (42 U.S.C 300j-12). This provision does not apply if the Department of Health approved the engineering plans and specification for the project prior to January 17, 2014.

The contractor acknowledges to and for the benefit of the project owner and Washington State that she or he understands that the Drinking Water State Revolving Loan Fund is paying for the goods and services under this agreement. DWSRF contains provisions, commonly known as “Buy American;” that requires all iron and steel products used in the project be produced in the United States (American Iron and Steel Requirements). The act defines iron and steel products as, “...the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.”

The contractor hereby represents and warrants to and for the benefit of the project owner and the state that:

- a) The contractor has reviewed and understands the American Iron and Steel Requirements,
- b) All of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirements, unless a waiver of the requirements is approved, and
- c) The contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirements, as may be requested by the project owner or the state.

Notwithstanding any other provisions of this agreement, any failure to comply with this paragraph by the contractor shall permit the project owner or state to recover as damages against the contractor any loss, expense or cost (including without limitation attorney’s fees) incurred by the project owner or state resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or part, from the state or any damages owed to the state by the project owner). While the contractor has no direct contractual obligation with the state, as a lender to the project owner for the funding of its project, the project owner and the contractor agree that the state is a third-party beneficiary and neither this paragraph nor any other provision of the agreement necessary to give this paragraph force or effect shall be amended or waived without the prior written consent of the state.

PART 4

**SUPPLEMENTARY GENERAL CONDITIONS
AND GENERAL CONDITIONS**

SUPPLEMENTARY GENERAL CONDITIONS

The General Conditions shall be supplemented as follows:

3.03.4(3) Apprentices

Add this Section in its entirety:

3.03.4(3.1) **Apprentice Utilization**

Apprentice Utilization

This Contract includes an Apprentice Utilization Requirement. Fifteen percent or more of project Labor Hours shall be performed by Apprentices unless Good Faith Efforts are accepted. Apprentice Utilization will be determined using the Department of Labor and Industries (L&I) online Prevailing Wage Intent & Affidavit (PWIA) system.

Definitions

For the purposes of this specification the following definitions apply:

1. Apprentice is a person enrolled in a State-approved Apprenticeship Training Program.
2. Apprentice Utilization is the apprentice labor hours, on the project, expressed as a percentage of project Labor Hours based on certified payrolls or the affidavits of wages paid, whichever is least. The percentage is not rounded up.
3. Apprentice Utilization Requirement is the minimum percentage of apprentice labor hours required by the Contract.
4. Good Faith Effort(s) (GFE) describes the Contractor's efforts to meet the Apprentice Utilization Requirement including but not limited to the specific steps as described elsewhere in this specification.
5. Labor Hours are the total hours performed by all workers receiving an hourly wage who are subject to prevailing wage requirements for work performed on the Contract as defined by RCW 39.04.310. Labor Hours are determined based on the scope of work performed by the individuals, rather than the title of their occupations in accordance with WAC 296-127.
6. State-approved Apprenticeship Training Program is an apprenticeship training program approved by the Washington State Apprenticeship Council.

7. Apprentice Wage Rates are the applicable wage rates that are to be paid for an apprentice registered in a training program, separate from Journey Level rates, as set by the Washington State Apprenticeship Training Council and Washington State Department of Labor and Industries (L&I).

Electronic Reporting

The Contractor shall use the PWIA System to submit the “Apprentice Utilization Plan.” Reporting instructions are available in the application.

Apprentice Utilization Plan

The Contractor shall submit an “Apprentice Utilization Plan” by filling out the Apprentice Utilization Plan Form (WSDOT Form 424-004) within 30 calendar days of execution, however no later than the preconstruction meeting, demonstrating how and when they intend to achieve the Apprentice Utilization Requirement. The Plan shall be in sufficient detail for the Engineer to track the Contractor’s progress in meeting the utilization requirements. An Apprentice Utilization Plan shall be updated and resubmitted as the Work progresses or when requested by the Engineer.

If the Contractor is unable to demonstrate the ability to meet the Apprentice Utilization Requirement with their initial Apprentice Utilization Plan submission, an effort must be made to find additional registered apprentices to perform on the contract. If after attempts have been made at every tier and every scope, the Contractor must submit GFE documentation to the Contracting Agency. The Contractor shall actively seek out opportunities to meet the Apprentice Utilization Requirement during the construction Work.

Contacts

The Contractor may obtain information on State-approved Apprenticeship Training Programs by using the [Apprentice Registration and Tracking System \(ARTS\)](https://secure.lni.wa.gov/arts-public/#/program-search) <https://secure.lni.wa.gov/arts-public/#/program-search> or contacting the Department of Labor and Industries directly at:

Specialty Compliance and Services Division, Apprenticeship Section, P.O. Box 44530, Olympia, WA 98504-4530 or by phone at (360) 902-5320.

Compliance

The Contractor is expected to make attempts to employ Apprentices and shall include the requirement in any subcontracts at any tier. In the event that the Contractor is unable to achieve the Apprentice Utilization Requirement, the Contractor shall submit GFE documentation demonstrating the efforts and attempts they made. Final GFE documentation shall be submitted to the Contracting Agency after Substantial Completion but no later than 30 days after Physical Completion.

If the Contractor fails to actively attempt to employ Apprentices, submit GFE documentation, or if the Engineer does not approve the GFE, the Contractor will be assessed a penalty. The Engineer will provide the Contractor with a written notice at Final Acceptance of the project informing the Contractor of the failure to comply with this specification which will include a calculation of the penalty to be assessed as provided for in the Payment section in this special provision.

If the Contractor achieves the required Apprentice Utilization an incentive will be assessed with Final Payment.

Good Faith Efforts

The GFE shall document the attempts (efforts) the Contractor (and any subcontractor at any tier) made to meet the Apprentice Utilization Requirement. Emails, letters, or other written communications with letterhead, titles, and contact information are required.

Documentation must include one or more of the following accepted GFEs:

1. Demonstrated Lack of Availability of Apprentices. Correspondence from State-approved Apprenticeship Training Program(s), with project specific responses confirming there is a lack of availability of Apprentices for this project.
2. Demonstrated Disproportionate Ratio of Material/Equipment/Products to Labor Hours. Documentation explaining the bid includes a disproportionate high cost of material/equipment/products to Labor Hours. (E.g., a \$2 M estimated contract includes \$1 M or more in procurement costs of equipment to be installed.)
3. Demonstrated Lack of Necessary Labor Hours. Correspondence from a State-approved Apprentice Training Programs confirming there is not enough time in the project to meet required journey level to apprentice training ratios.
4. Demonstrated Lack of Available Approved Programs. Correspondence from State-approved Apprentice Training Programs, confirming there are no programs that train for the scopes included/anticipated on the project. Contractor and state programs to submit training program detail needs and details that could be used for future program creation.
5. Funding Precedent. Documentation that shows conflicting, more restrictive, or precedent requirements for other training on the Project. Examples include, but are not limited to, Tribal Employment Rights (TERO), Federal Training Hours, or Special Training that affect the ability to use state-registered apprentices.

6. Warranty Work. Documentation from Original Equipment Manufacturers, or similar, confirming that work performed must only be completed by certified journey-level installers or risk voiding warranty, or similar.
7. Other Effort. The Contractor may submit other evidence, documentation, or rationale for not being able to achieve the required Apprentice Utilization that are not covered in the other efforts named. Other efforts will still need to be corroborated by an independent, knowledgeable third-party.

Contractors may receive a GFE credit for graduated Apprentice hours through the end of the calendar year for all projects worked on as long as the Apprentice remains continuously employed with the same Contractor/subcontractor they were working for when they graduated. If an Apprentice graduates during employment on a project of significant duration, they may be counted towards a GFE credit for up to 1 year after their graduation or until the end of the project (whichever comes first). Determination of whether Contract requirements were met in good faith will be made by subtracting the hours from the journeyman total reported hours for the project and adding them to the apprentice hour total. If the new utilization percentage meets the Contract requirement, the Contractor will be reported as meeting the requirement in good faith.

Approving Good Faith Efforts

The Contracting Agency will review submitted Good Faith Efforts and issue a determination. The Engineer may request additional information, documentation, evidence or similar in order to approve such efforts. A determination by the Engineer is final. The approved Good Faith Efforts will be loaded into the PWIA system by the Contracting Agency.

GENERAL CONDITIONS

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GENERAL CONDITIONS

SECTION 1 - GENERAL INFORMATION APPLICABLE TO PROPOSAL AND CONTRACT

1.01 DEFINITIONS AND TERMINOLOGY

The following terms are abbreviated and defined as they are used in the Contract. When used in the Proposal form to denote items of Work and units of measurements, abbreviations mean the full expression of the abbreviated term.

1.02 ABBREVIATIONS AND TERMINOLOGY

1.02.1 REFERENCED STANDARDS AND CODES

The following is a partial list of specifications and codes that may be referenced in sections of the Contract. The Contractor shall be responsible for conducting its Work and carrying out its operations and furnishing equipment in accordance with the latest edition or versions, in effect at the time of bid opening, of any applicable specified portions of the referenced standards and codes.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti-friction Bearing Manufacturing Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANLA	American Nursery and Landscape Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ARA	American Railway Association
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASME	American Society Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Material
AWPA	American Wood Preservers' Association
AWS	American Welding Society

AWWA	American Water Works Association
CFR	Code of Federal Regulations
CLI	Chain Link Institute
CRAB	County Road Administration Board
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Associations
CSI	Construction Specifications Institute
DIPRA	Ductile Iron Pipe Research Association
EEI	Edison Electric Institute
EPA	Environmental Protection Agency
ETL	Electrical Testing Laboratories
FHWA	Federal Highway Administration
FM	Factory Mutual
FSS	Federal Specifications and Standards, General Services Administration
HUD	United State Department of Housing and Urban Development
IBC	International Building Code
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illumination Engineering Society
IMSA	International Municipal Signal Association
IPC	International Plumbing Code
ISA	Instrumentation Society of America
JIC	Joint Industry Conference Electrical Standards for Industrial Equipment
LID	Local Improvement District
LPI	Lightning Protection Institute
MSHA	Mine Safety and Health Act
MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
MUTCD	Manual on Uniform Traffic Control Devices
NCMA	National Concrete Manufacturer's Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NRMCA	National Ready Mix Concrete Association
OMWBE	Office of Minority and Women's Business Enterprises
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastic Pipe Institute
P/PCI	Precast/Prestressed Concrete Institute
RCW	Revised Code of Washington
SAE	Society of Automotive Engineers
SEPA	State Environmental Policy Act
SIES	Specifications and Illuminating Engineering Society
SSPC	Steel Structures Painting Council
UL	Underwriters' Laboratory
ULID	Utility Local Improvement District
UMTA	Urban Mass Transit Administration

WABO	Washington Association of Building Officials
WAC	Washington Administrative Code
WCLIB	West Coast Lumber Inspection Bureau
WISHA	Washington Industrial Safety and Health Administration
WRI	Wire Reinforcement Institute
WSDL&I	Washington State Department of Labor and Industries
WSDOE	Washington State Department of Ecology
WSDOT	Washington State Department of Transportation
WWPA	Western Wood Products Association

1.02.2 TERMINOLOGY

The use of pronouns of any gender in these General Conditions shall include pronouns of all genders, as applicable.

The terms “provide,” “furnish” and “install” are used interchangeably in the Contract and mean that the Contractor shall provide, furnish, and install the item(s) described unless specifically noted otherwise.

The terms “Plans” and “Drawings” are used interchangeably in the Contract and shall mean the Contract Plans, which show location, character, and dimensions of prescribed Work, including layouts, profiles, cross-sections, and other details.

1.02.3 ITEMS OF WORK AND UNITS OF MEASUREMENT

AC	Asbestos Cement Pipe
Agg.	Aggregate
Al.	Aluminum
ATB	Asphalt Treated Base
BST	Bituminous Surface Treatment
CB	Catch Basin
Cfm	Cubic Feet per Minute
Cfs	Cubic Feet per Second
Cl.	Class
CMP	Corrugated Metal Pipe
Comb.	Combination
Conc.	Concrete
CPEP	Corrugated Polyethylene Pipe
Crib.	Cribbing
Culv.	Culvert
Cy or Cu. Yd.	Cubic Yard(s)
Dia.	Diameter
DI	Ductile Iron
DIM	Dimension
EA	Each
EL	Elevation
Est.	Estimate or Estimated

Excl.	Excluding
F	Fahrenheit
FIG	Figure
Ft.	Foot or Feet
GALV	Galvanized
Gph	Gallon(s) per Hour
Gpm	Gallon(s) per Minute
HDPE	High Density Polyethylene
HMA	Hot Mix Asphalt
HR	Hour
Hund.	Hundred
In.	Inch or Inches
Incl.	Including
L	Liter
Lb.	Pound(s)
LF or Lin. Ft.	Linear Foot (Feet)
LS	Lump Sum
M	Thousand
MBM	Thousand Feet Board Measure
Pres.	Pressure
PSI	Pounds per Square Inch
PSF	Pounds per Square Foot
PVC	Polyvinyl Chloride
QTY	Quantity
Reg.	Regulator
Reinf.	Reinforced, Reinforcing
SF	Square Foot (Feet)
Sec.	Section
SL	Slope
St.	Street
Stl.	Steel
SST	Stainless Steel
Str.	Structural
Sy or Sq. Yd.	Square Yard(s)
Th.	Thick or Thickness
TN	Ton
Tr.	Treatment
TYP	Typical
VC	Vitrified Clay

1.03 DEFINITIONS

ACCEPTANCE

The formal action by Owner or Owner's governing body as provided in RCW 39.08 and RCW 60.28.

ADDENDUM

A written or graphic document issued to all Bidders prior to bid opening and identified as an addendum, which clarifies, modifies or supplements the bid documents and becomes part of the Contract.

ADDITIVE

A supplemental unit of work or group of bid items, identified separately in the Proposal, which may, at the discretion of the Owner, 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 Proposal, from which the Owner may make a choice between different methods or material of construction for performing the same work.

AWARD

The formal decision of the Owner awarding the Contract to the lowest or most favorable responsible and responsive Bidder for the Work.

BID DOCUMENTS

The component parts of the proposed Contract which may include, but not limited to, the Proposal form, the proposed Contract Provisions, the proposed Contract Plans, Addenda, and Subsurface Boring Logs (if any).

BIDDER

A natural person or legal entity (e.g., partnership, corporation, limited liability company, firm, or joint venture) submitting a proposal or bid.

BUSINESS DAY

A business day is any day from Monday through Friday, except holidays, as listed in Section 3.04.14.

CLERK

The duly elected or appointed Clerk of the Commission, Council, or Board of Directors of the Owner.

COMMISSION, COUNCIL, OR BOARD OF DIRECTORS

The duly elected or appointed Council, Commission, or Board of Directors of the Owner.

CONTRACT

The written agreement between the Owner and the Contractor. It describes, among other things:

1. What work will be done, and by when;
2. Who will provide labor and materials; and
3. How Contractor will be paid.

The Contract includes: the agreement form, Bidder's completed Proposal form, all required certificates and affidavits, Performance Bond and Public Works Payment Bond, Contract Provisions, Contract Plans, Standard Plans, and all Addenda and Change Orders executed pursuant to the provisions of the Contract.

CONTRACT BOND

The approved form of security furnished by the Contractor and the Contractor's Surety as required by the Contract, that guarantees performance of all the Work required by the Contract and payment to anyone who provides supplies or labor for the performance of the Work.

CONTRACT DOCUMENTS

See definition for "Contract."

CONTRACT PLANS (PLANS OR DRAWINGS)

The Contract Plans (or drawings) are those plans, drawings or other illustrations and all addenda and revisions, whether issued before or after the award of the contract to Contractor, which show location, character, and dimensions of the Work, including layouts, profiles, cross-sections and other details.

CONTRACT PROVISIONS

A publication addressing the work required for an individual project. At the time of the call for bids, the contract provisions may include, for a specific individual project, general conditions, supplemental general conditions, specifications, a listing of the applicable standard plans, the prevailing minimum hourly wage rates, and an informational proposal form with the listing of bid items. The proposed contract provisions may also include, for a specific individual project, various required certifications or declarations. At the time of the contract execution date, the contract provisions include the proposed contract provisions and include any addenda, a copy of the agreement form, and a copy of the proposal form with the contract prices and extensions.

CONTRACT TIME

Contract time shall mean the number of calendar days stated in the Contract for completion of work or specified portions thereof.

CONTRACTOR

The natural person(s) or legal entity (e.g., partnership, corporation, limited liability company, firm, joint venture) awarded the contract to perform the Work pursuant to the Contract Documents.

DATES

Substantial Completion Date is the day that the Engineer determines the Owner has full and unrestricted use and benefit of the Work, from both an 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 Work.

Physical Completion Date is the day that the Engineer determines that all of the Work required by the Contract is physically completed and the Owner has received from the Contractor all required record drawings, operation and maintenance manuals, manufacturers' affidavits, and software and programming.

Contract Completion Date is the day when all the Work and all the obligations of the Contractor under the Contract are fulfilled by the Contractor. All documentation and other items required by the Contract and required by law shall be furnished by the Contractor before establishment of this date.

Final Acceptance Date is the date on which the Owner accepts the work as complete.

FIELD REPRESENTATIVE

The Owner's representative who observes the Contractor's performance of the Work. Such observation shall not be relied upon by the Contractor or others as approval or acceptance of the Work, nor shall it in any manner relieve the Contractor from its obligations and responsibilities under the Contract.

NOTICE TO PROCEED

The written notice from the Owner or Engineer to the Contractor authorizing and directing the Contractor to proceed with the Work and establishing the date on which the Contract Time begins.

OWNER

The government entity or agency that awards the contract to the Contractor and is responsible for the execution and administration of the Contract.

PROJECT ENGINEER/ENGINEER

The Owner’s staff or representative who administers the construction program for the Owner.

PROPOSAL (or BID)

A Bidder’s offer, on a properly completed Proposal form, to perform the Work required by the Contract. The terms Proposal and Bid may be used interchangeably.

SPECIFICATIONS

Written provisions describing the Work and requirements thereof.

STANDARD PLANS

A manual of specific plans or drawings adopted by the Owner, which show frequently recurring components of work that, have been standardized for use.

SUBCONTRACTOR

A natural person, or entity (e.g., partnership, corporation, limited liability company, firm or joint venture) to which the Contractor sublets a portion of the Work.

SUBGRADE

The top surface of the roadbed on which subbase, base, surfacing, pavement, or layers of similar materials are placed.

SUPPLEMENTARY GENERAL CONDITIONS

That part of the Contract amends or supplements these General Conditions.

TRAVELED WAY

That part of the roadway made for vehicle travel, excluding shoulders and auxiliary lanes.

WORK

The provision of all labor, materials, tools, equipment, supervision and other things needed to complete the project in full accordance with the Contract Documents.

WORKING DRAWINGS

Shop drawings, shop plans, erection plans, falsework plans, framework plans, cofferdam, cribbing and shoring plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data, including a schedule of submittal dates for working drawings where specified, that the Contractor shall submit to the Engineer for approval.

SECTION 2 - INSTRUCTIONS FOR PREPARATION OF PROPOSAL (OR BID)

2.01 BID PROCEDURES AND CONDITIONS

2.01.1 QUALIFICATIONS OF BIDDERS

Where applicable and required, Bidders shall provide all requested information relating to experience, financing, equipment, and organization relating to their ability to properly perform the Work. The Owner reserves the right to take whatever action it deems necessary to ascertain the responsibility of the Bidder and the ability of the Bidder to perform the Work satisfactorily.

2.01.2 CONTRACT PROVISIONS AND CONTRACT PLANS

Contract Provisions and Contract Plans are on file in the offices of the Owner and the Engineer, Gray & Osborne, Inc. After award of the Contract, five sets of Contracts will be issued without charge to the Contractor. Additional sets of Contracts may be purchased from the Owner by the Contractor.

2.01.3 ESTIMATED QUANTITIES

The quantities shown in the Proposal form are estimates and are stated only for bid comparison purposes. The Owner does not warrant, expressly or by implication, that the actual quantities will correspond with those estimates. Payment will be made on the basis of the actual quantities of each item of Work satisfactorily completed in accordance with the requirements of the Contract.

2.01.4 EXAMINATION OF CONTRACT AND SITE

2.01.4(1) General

Bidders shall satisfy themselves by personal examination of Contract Provisions, Contract Plans, and site of the proposed improvements, and by any other examination and investigation which they may desire to make as to the accuracy of the estimate of quantities, the nature of the Work and the difficulties to be encountered. Bidders shall review the entire Contract to ensure that the completeness of their Proposal includes all items of Work regardless of where shown in the Contract. Bidders are cautioned that alternate sources of information (copies of the Contract obtained from third parties) are not necessarily an accurate or complete representation of the Contract. Bidders shall use such information at their own risk.

Bidders shall be familiar and comply with all applicable federal, state, and local laws, ordinances, and regulations in any way applicable to the performance the Work. Bidders are responsible for familiarizing themselves with all current state wage rates applicable to the Work and its duration before submitting a Proposal based on the Contract Provisions and Contract Plans. Any wage determination contained in the Contract is for the Bidder's general information only and is not warranted to be complete or accurate. The Owner will not consider any plea of misunderstanding or ignorance of such requirements. Bid prices shall reflect what the Bidder has determined to be the total cost of completing the Work, including but not limited to: construction methods, materials, labor, administrative costs, any and all applicable taxes, and equipment. Except as the

Contract may provide, the Bidder to which the contract is awarded shall receive no payment for any costs that exceed those set forth in the Proposal.

2.01.4(2) Interpretation of the Contract Provisions and Contract Plans

If any Bidder desires interpretation or clarification of the Contract Provisions and Contract Plans, the Bidder shall make a written request to the Engineer for such clarification or interpretation prior to the submission of a Proposal. If the Engineer determines that the Contract Provisions and/or Contract Plans do not require interpretation or clarification, the Engineer will so notify the Bidder making the request. All interpretations and clarifications made by the Engineer will be by written addendum to all planholders of record, and a copy of the addendum will be filed in the office of the Owner. Neither the Owner nor the Engineer will be responsible for any interpretation, clarification or explanation of the Contract Provisions and Contract Plans that is not set forth in a written addendum to all planholders of record, and Bidders shall not under any circumstances rely on any other interpretation, clarification or explanation.

2.01.4(3) Subsurface Information

If the Owner has made a subsurface investigation of the site of the proposed Work, the boring log data and soil sample test data accumulated by the Owner will be made available for inspection by the Bidders. However, the Owner makes no representation or warranty, express or implied, that:

- a. The Bidders' interpretations from the boring logs may be correct;
- b. Moisture conditions and indicated water tables will not vary from those found at the time the borings were made;
- c. The ground at the location of the borings has not been physically disturbed or altered after the boring was made; and
- d. Conditions below the surface of the ground are consistent throughout the site with the information made available hereunder, or that conditions to be encountered on the site are uniform or consistent with geological conditions usually encountered in the area.

The Owner makes no representations, guarantees, or warranties as to the condition, materials, or proportions of the materials between the specific borings, regardless of any subsurface information the Owner may make available to the prospective Bidders. Bidders are solely responsible for making the necessary investigations to support and/or verify any conclusions or assumptions used in preparation of their Proposals.

Any subsurface investigations and analysis were carried out for design purposes only. Contractor may not rely upon or make any claim against Owner, Engineer, or any of their subconsultants, with respect to:

1. The completeness of such 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 conclusions, interpretations, opinions, representations, and information contained in such reports; or
3. Any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, conclusions, interpretations, opinions or information.

2.01.4(4) Availability of Specified Items

Prior to submitting a Proposal, all Bidders shall verify that all items necessary to complete the Work will be available in time to allow the Work to be completed within the Contract Time. In the event that one or more items may not be available to allow the Work to be completed within the Contract Time, the Bidder shall notify the Engineer in writing prior to submitting a Proposal. Responsibility for delays and related costs because of non-availability of items necessary to complete the Work shall be borne by the Contractor.

2.01.5 PROPOSAL DEPOSIT

A deposit of at least 5 percent of the total Proposal amount shall accompany each Proposal. This deposit may be in the form of a Proposal bond (surety bond), certified check, cashier’s check, or postal money order made payable to the Owner. All Proposal bonds shall be on the form included within the Contract Provisions and shall be signed by the Bidder and the surety. The surety shall: (1) be registered with the Washington State Commissioner, and (2) appear on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner. The Proposal bond shall not be conditioned in any way to modify the minimum 5 percent required. The Proposal Deposit will be held as a guaranty that the successful Bidder will, within 10 days from the date of notification of Award, enter into a Contract and furnish approved Performance and Public Works Payment Bonds, on forms attached, in amounts equal to 100 percent of the amount of the Contract, including state sales tax.

2.01.6 PROPOSAL

- (1) Proposals shall be submitted on the Proposal form included in the Contract Provisions. All Proposals shall be completed, signed by an authorized person and dated. To be considered by the Owner as a responsive Proposal, the Bidder shall bid on all Additive or Alternate items set forth in the Proposal form, unless otherwise specified in the Contract Documents.
- (2) To be responsive, a Proposal shall state that it will remain valid for a period of 60 days following the date of Proposal opening. In the event that a conflict in this duration appears elsewhere in the Contract Provisions, the longest duration shall apply.
- (3) All prices set forth on the Proposal form shall be legible and either be written in ink or typed. In the space provided on the Proposal form, Bidders shall identify all

Addenda that have been received. The Proposal, Bid bond, and all other certificates, forms or other documents required by the Contract Provisions to be executed and delivered with the Proposal shall be submitted in a sealed package, addressed to the Owner, and plainly marked “Proposal for _____ (insert name of project as shown on the Proposal) to be opened on the _____ day of _____, 20____,” (insert the day, month and year shown in the published bid notice). The Owner will not consider any Proposal received after the time established for opening Proposals.

- (4) Where noted in the Proposal, the Bidder to furnish information concerning its experience with work of a similar nature, equipment to be used on this project, and general background information. Information that is incomplete, evasive, or of a general nature only, may be considered as grounds for rejection of the Proposal.
- (5) The apparent successful Bidder may be required to submit to the Engineer as soon as possible after the Proposal opening, and not later than three calendar days thereafter, a written list of all proposed Subcontractors that will perform subcontracting Work on the Project. If not previously provided, the following information shall be provided for each Subcontractor:
 - a. Name, address, email address, facsimile number, telephone number, contractor registration number and certification numbers;
 - b. The type of Work to be performed;
- (6) After opening and reading Proposals, the Owner 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, converted to the actual extension, will control. The total extensions, corrected where necessary, will be used by the Owner for comparison and award purposes and to establish the amount of the Contractor’s Performance and Public Works Payment Bonds.

2.01.7 WITHDRAWING OR REVISING PROPOSAL

After submitting a physical Proposal to the Owner, the Bidder may withdraw, or revise it if:

1. The Bidder submits a written request signed by an authorized person and physically delivers it to the place designated for receipt of Proposals; and
2. The Owner receives the request before the time set for receipt of Proposals; and
3. The revised or supplemented Proposal (if any) is received by the Owner before the time set for receipt of Proposals.

If the Bidder’s request to withdraw or revise its Proposal is received before the time set for receipt of Proposals, the Owner will return the unopened Proposal package to the Bidder. The Bidder

must then submit the revised package in its entirety. If the Bidder does not submit a revised package, then its bid shall be considered withdrawn.

The District's server clock will serve as the official time clock for submittal of bid proposals.

Late revised Proposals or late withdrawal requests will be date recorded by the Owner and returned unopened. Mailed, emailed, or faxed requests to withdraw or revise a Bid Proposal are not acceptable.

2.01.8 DISQUALIFICATION OF BIDDERS

1. A proposal will be considered irregular and will be rejected if:
 - a. The authorized proposal form furnished by the Owner is not used or is altered;
 - b. The completed proposal form contains any unauthorized additions, deletions, alternate Bids, or conditions;
 - c. The Bidder adds provisions reserving the right to reject or accept the award, or enter into the Contract;
 - d. A price per unit cannot be determined from the Bid Proposal;
 - e. The Proposal form is not properly executed;
 - f. The Bidder fails to submit or properly complete a Subcontractor list, if applicable;
 - g. The Bidder fails to submit or properly complete a Disadvantaged, Minority or Women's Business Enterprise Certification, if applicable;
 - h. The Bid Proposal does not constitute a definite and unqualified offer to meet the material terms of the Bid invitation; or
 - i. More than one proposal is submitted for the same project from a Bidder under the same or different names.

2. A Proposal may be considered irregular and may be rejected if:
 - a. The Proposal does not include a unit price for every Bid item;
 - b. Any of the unit prices are excessively unbalanced (either above or below the amount of a reasonable Bid) to the potential detriment of the Owner;
 - c. Receipt of Addenda is not acknowledged;
 - d. A member of a joint venture or partnership and the joint venture or partnership submit Proposals for the same project (in such an instance, both Bids may be rejected); or
 - e. If Proposal form entries are not made in ink.

3. A Bidder will be deemed not responsible if the Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or does not meet Supplemental Criteria 1 through 8 in this Section:

The Owner will verify that the Bidder meets the mandatory bidder responsibility criteria in RCW 39.04.350(1), and Supplemental Criteria 1. Evidence that the

Bidder meets Supplemental Criteria 2 through 8 shall be provided by the Bidder as stated later in this Section.

a. **Criteria 1 – Federal Debarment**

1. Criterion: The Bidder shall not currently be debarred or suspended by the Federal government.
2. Documentation: The Bidder shall not be listed as having an “active exclusion” on the U.S. government’s “System for Award Management” database (www.sam.gov).

b. **Criteria 2 – Delinquent State Taxes**

1. Criterion: The Bidder shall not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.
2. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Owner) that the Bidder does not owe delinquent taxes to the Department of Revenue. If the Bidder owes delinquent taxes, they must submit a written payment plan approved by the Department of Revenue, to the Owner by the deadline listed below.

c. **Criteria 3 – Subcontractor Responsibility**

1. Criterion: The Bidder’s standard subcontract form shall include the subcontractor responsibility language required by RCW 39.06.020, and the Bidder shall have an established procedure which it utilizes to validate the responsibility of each of its subcontractors. The Bidder’s subcontract form shall also include a requirement that each of its subcontractors shall have and document a similar procedure to determine whether the sub-tier subcontractors with whom it contracts are also “responsible” subcontractors as defined by RCW 39.06.020.
2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder complies with the subcontractor responsibility requirements of RCW 39.06.020.

d. **Criteria 4 – Claims Against Retainage and Bonds**

1. Criterion: The Bidder shall not have a record of excessive claims filed against the retainage or payment bonds for public works projects in the 3 years prior to the bid submittal date, that

demonstrate a lack of effective management by the Bidder of making timely and appropriate payments to its Subcontractors, suppliers, and workers, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.

2. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Owner) that the Bidder has not had claims against retainage and bonds in the 3 years prior to the bid submittal date. If the Bidder has had claims against retainage and bonds in the three years prior to the bid submittal date, they shall submit a list of the public works projects completed in the 3 years prior to the bid submittal date that have had claims against retainage and bonds and include for each project the following information:

- Name of project
- The owner and contact information for the owner;
- A list of claims filed against the retainage and/or payment bond for any of the projects listed;
- A written explanation of the circumstances surrounding each claim and the ultimate resolution of the claim.

e. **Criteria 5 – Public Bidding Crime**

1. Criterion: The Bidder and/or its owners shall not have been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.
2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder and/or its owners have not been convicted of a crime involving bidding on a public works contract.

f. **Criteria 6 – Termination for Cause / Termination for Default**

1. Criterion: The Bidder shall not have had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date; or if Bidder was terminated, describe the circumstances.

g. **Criteria 7 – Lawsuits**

1. **Criterion:** The Bidder shall not have lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, or shall submit a list of all lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date, along with a written explanation of the circumstances surrounding each such lawsuit. The Owner shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet of terms of construction related contracts.

h. **Criteria 8 – Contract Time (Liquidated Damages)**

1. **Criterion:** The Bidder shall not have had liquated damages assessed on any projects it has completed 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet Contract Time, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Owner.
2. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Owner) that the Bidder has not had liquidated damages assessed on any projects it has completed within the 5 years prior to the bid submittal date, or shall submit a list of projects with assessed liquated damages along with Owner contact information, and number of days assessed liquated damages.

i. **Criteria 9 – Capacity and Experience**

1. **Criterion:** The Bidder shall have sufficient current capacity and the project superintendent assigned to the project shall have experience to meet the requirements of this project. The Bidder and the project superintendent shall have successfully completed at least two projects as the prime contractor, of a similar size and scope, during the 5-year period immediately preceding the bid submittal deadline for this project. Similar size is defined as a minimum of 70 percent of the bid amount submitted by the Bidder.

2. Documentation: The Bidder shall, if and when required as detailed below, on a form to be provided by the Owner, provide the Bidder's gross dollar amount of work currently under contract, the Bidder's gross dollar amount of contracts currently not completed, five major pieces of equipment anticipated to be on the project and whether the equipment is leased or owned, the superintendent assigned to this project and their number of years of experience, and two project references of similar size and scope during the 5-year period immediately preceding the bid submittal deadline for this project. The Owner may check owner references for the previous projects and may evaluate the owner's assessment of the Bidder performance.

As evidence that the Bidder meets Supplemental Responsibility Criteria 2 through 9 stated above, the apparent two lowest Bidders must submit to the Owner by 12:00 P.M. (noon) of the second business day following the bid submittal deadline, a written statement verifying that the Bidder meets Supplemental Criteria 2 through 9 together with supporting documentation (sufficient in the sole judgment of the Owner) demonstrating compliance with Supplemental Responsibility Criteria 2 through 9. The Owner reserves the right to request further documentation as needed from the low bidder and documentation from other Bidders as well to assess Bidder responsibility and compliance with all bidder responsibility criteria. The Owner also reserves the right to obtain information from third-parties and independent sources of information concerning a Bidder's compliance with the mandatory and Supplemental Criteria, and to use that information in their evaluation. The Owner may consider mitigating factors in determining whether the Bidder complies with the requirements of the Supplemental Criteria.

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

If the Owner determines the Bidder does not meet the bidder responsibility criteria above and is therefore not a responsible Bidder, the Owner shall notify the Bidder in writing, with the reasons for its determination. If the Bidder disagrees with this determination, it may appeal the determination within 2 business days of the Owner's determination by presenting its appeal and any additional information to the Owner. The Owner will consider the appeal and any additional information before issuing its final determination. If the final determination affirms that the Bidder is not responsible, the Owner will not execute a contract with any other Bidder until at least 2 business days after the Bidder determined to be not responsible has received the Owner's final determination.

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

2.01.9 PROPOSAL ERRORS

If a Bidder discovers an error in the Bidder's Proposal after the Proposals have been opened and tabulated and desires to withdraw the erroneous Proposal, the Bidder shall submit a notarized affidavit signed by the Bidder, accompanied by original certified worksheets used in the preparation of the Proposal, requesting relief from the Award. The affidavit shall describe the specific error(s) and certify that the worksheets are the originals used in the preparation of the Proposal.

The affidavit and the certified worksheets shall be received by the Engineer before 5:00 p.m. local time on the next business day following the day of the Proposal opening or the claim of error will not be considered. The Engineer will review the certified worksheets to determine the validity of the claimed error, and make its recommendation to the Owner. If the Owner and Engineer concur that the claim of error is allowable under applicable law, the Bidder will be relieved of responsibility for the Proposal, and the Proposal Deposit will be returned to the Bidder. Thereafter, at the discretion of the Owner, all Proposals may be rejected or an Award made to the next lowest responsive, responsible Bidder.

2.02 AWARD AND EXECUTION OF CONTRACT

2.02.1 AWARD OF CONTRACT

A Contract will not be awarded until the Owner is satisfied that the successful Bidder is responsible, reasonably familiar with the Work to be performed and has the necessary capital, tools, personnel and equipment to satisfactorily perform the Work.

The Owner reserves the right to waive informalities in the bidding, accept a Proposal of the lowest responsive, responsible Bidder, reject any or all Proposals, republish the call for Proposals, or revise or cancel the project.

After the date and hour set for the opening of the Proposals, no Bidder may withdraw its Proposal unless the Award of the Contract is delayed for a period exceeding 60 calendar days following Proposal opening. In the event that a conflicting duration appears elsewhere in the Invitation for Proposals or Contract Provisions or advertisement, the longer period shall govern.

2.02.2 EXECUTION OF CONTRACT

Within 10 calendar days after notification by the Owner of the Award, the successful Bidder shall return to the Engineer the signed Owner-prepared Contract, all insurance certificates and endorsements required by the Contract Provisions, all other certificates, information, and forms required by the Contract Provisions, and Performance and Public Works Payment Bonds required by the Contract Provisions. If the Contract is signed by an officer, agent, or other authorized representative of the Contractor, the officer, agent, or other representative shall furnish satisfactory evidence of authority to sign as the legal representative of the Contractor, if required by the Owner. An authorized partner of a joint venture may sign the Contract, subject to the approval of the Owner, which may, at its discretion, require each and every member of the joint venture to sign the Contract.

Should the successful bidder fail to return to the Engineer the signed Owner-prepared Contract, all insurance certificates and endorsements required by the Contract Provisions, all other certifications, information, and forms required by the Contract Provisions, and Performance and Public Works Payment Bonds required by the Contract Provisions within 10 calendar days after notification by the Owner of the Award, the Owner reserves the right to and may elect to withdraw the award to the successful bidder and award the Contract to the next responsible, responsive bidder.

Until the Owner executes the Contract, no Proposal shall bind the Owner, and the Contractor shall not commence any Work. The Contractor shall bear all risks for any Work begun before the Contract is executed by the Owner.

2.02.3 FAILURE TO EXECUTE CONTRACT

If the Contractor fails to submit the insurance certificates, bonds, and all other certificates, forms, information and documents as required by the Contract Provisions, with the executed Contract within the time required by the Contract Provisions, the Owner may then award the Contract to the next lowest responsive, responsible Bidder or reject any or all Proposals.

2.02.4 RETURN OF BID DEPOSIT

When Proposals have been examined and corrected as necessary, proposal bonds and deposits accompanying Proposals ineligible for further consideration will be returned. All other Proposal bonds and deposits will be held until the Contract is awarded and fully executed, after which the Proposal bonds and deposits, except those subject to forfeiture, will be returned.

2.02.5 NOTICE TO PROCEED

A written Notice to Proceed will be issued to the Contractor by the Owner or Engineer after the Contract has been executed by the Contractor and the Owner, and the Performance and Public Works Payment Bonds and required insurance and other certificates and documents are approved by the Owner and, when applicable, by State or Federal agencies responsible for funding any portion of the project. The Contractor shall not commence Work until the Notice to Proceed has been issued.

SECTION 3 - GENERAL REQUIREMENTS OF THE CONTRACT

3.01 SCOPE OF THE WORK

3.01.1 INTENT OF THE CONTRACT

The intent of the Contract is to describe a functionally complete project to be constructed in accordance with the Contract. The Contractor shall provide all labor, supervision, materials, tools, equipment, transportation, supplies, and other things required expressly by, or reasonably implied from, the Contract, to complete all Work. Omissions from the Contract of details of Work which are necessary to carry out the intent of the Contract, or which are customarily performed, shall not relieve the Contractor from performing the complete Work called for by the Contract; such Work shall be performed as if fully set forth and described in the Contract. The unit or other bid prices shall be full payment for everything required to complete the Work, including but not limited to labor, supervision, materials, equipment, jobsite and home office overhead and profit.

3.01.2 COORDINATION OF CONTRACT

The Contract Plans and the Contract Provisions for the Work shall be considered as a whole, and anything shown or called for in one and omitted in any other is as binding as if called for or shown on both. Figure dimensions shall, in all cases, be used in preference to scale dimensions. Any inconsistency in the Contract Documents shall be resolved by the following order of precedence (e.g., 1 presiding over 2 through 4, 2 presiding over 3 through 4, etc.):

1. Addenda;
2. The Agreement and Proposal Form;
3. Specifications;
- 3a. Supplementary General Conditions (including conditions supplied by federal or state agencies on projects funded, in whole or part, by such agencies. In the event of a conflict in various forms of General Conditions, those conditions affording the greatest benefit or protection to the Owner shall govern.);
- 3b. General Conditions;
- 3c. Technical Specifications;
4. Contract Plans.

3.01.3 ASSIGNMENT OF CONTRACT

The Contractor shall not assign the Contract or any part of the Contract or of the funds to be received under the Contract unless such assignment is approved by the Owner and the Contractor's Performance and Public Works Payment Bonds surety prior to the execution or effectiveness of the assignment.

3.02 CONTROL OF WORK

3.02.1 AUTHORITY AND ROLE OF THE ENGINEER

- (1) The Engineer is the authorized representative of the Owner, and is employed to act as advisor and consultant to the Owner in engineering matters relating to the Contract. Among other things, the Engineer may determine the quantity of material installed or work completed, evaluate whether materials and equipment comply with the Specifications, and assist the Owner with answering questions relating to the meaning and intent of the Contract. The Owner, with the advice of the Engineer, will make the final determination relating to quality, acceptability and conformity of labor and materials to the requirements of the Contract.
- (2) The Engineer does not purport to be a safety expert, and is not engaged in that capacity under the Contract or the Engineer's contract with the Owner. The Engineer does not have either the authority or the responsibility to enforce construction safety laws, rules, regulations or procedures, or to order the stoppage of Work for claimed violations thereof. From time to time, the Engineer may inform the Contractor of conditions that may constitute safety issues or violations. Such information will be provided solely to cooperate with and assist the Contractor and shall not make the Field Representative or the Engineer responsible for the enforcement of safety laws, rules, regulations or procedures. After receiving information relating to safety issues from the Engineer, the Contractor shall make its own examination and analysis of the situation reported and take such action, if any, that the Contractor determines to be appropriate. The Engineer's performance of project representation and observation services shall not make the Engineer responsible for the enforcement of safety laws, rules, regulations or procedures; nor shall it make the Engineer responsible for construction means, methods, techniques, sequences, or procedures, or for the Contractor's failure to properly perform the Work, all of which are entirely the responsibility of the Contractor.
- (3) The Engineer shall have no liability whatsoever to, or contractual relationship with, the Contractor in any way relating to the Contract. The Owner and the Contractor shall look solely to each other for the enforcement with respect to any rights, obligations, claims or liabilities arising under or in any way relating to the Contract. Neither the authority given to the Engineer herein, nor any action or service provided by the Engineer or its subconsultants with regard to the Project, shall create any duty owed by the Engineer or its subconsultants to the Contractor or a cause of action against the Engineer or its subconsultants by Contractor.
- (4) Nothing in the Contract shall, in any way, be construed to place responsibility on the Field Representative, Engineer or the Owner for the method, manner, direction or superintendency of the performance of the Work by the Contractor. Such responsibility rests solely with the Contractor.

- (5) Neither the Engineer nor any of its assistants or agents shall have any power to waive any obligation of the Contract. The Engineer's failure to reject Work that is defective or otherwise does not comply with the requirements of the Contract shall not constitute approval or acceptance of the Work or relieve the Contractor of its obligations under the Contract, notwithstanding that such Work has been estimated for payment or that payments have been made for that Work. Neither shall such failure to reject Work, nor any acceptance by the Engineer or by the Owner of any part or of the whole of the Work bar a claim by the Owner at any subsequent time for recovery of damages for the cost of removal and replacement of any portions of the Work that do not comply with the Contract.
- (6) No order, measurement, determination or certificate by the Engineer or Owner for payment of money or payment for or acceptance of the whole or of any part of the Work by the Engineer or the Owner or extension of time or possession taken by the Owner shall constitute a waiver of any portion of the Contract, nor shall any waiver of any breach of the Contract constitute a waiver of any other or subsequent breach thereof.

3.02.2 AUTHORITY OF FIELD REPRESENTATIVE

- (1) Field Representatives are assigned to the project site to keep the Engineer and Owner generally informed as to the progress of the Work and the manner in which it is being done; to keep records; and to act as liaison between the Contractor, Owner and Engineer. When observed, the Field Representative shall call the attention of the Contractor to any deviations from the Contract. However, failure of the Field Representative to call the attention of the Contractor to faulty Work or deviations from the Contract shall not constitute either a waiver of any requirement in the Contract or acceptance of said Work.
- (2) Since one of the Field Representative's primary responsibilities is to observe that the Work progresses expediently and in a workmanlike manner, he or she may offer suggestions to the Contractor, which the Contractor, at its sole discretion, may or may not choose to follow. Such suggestions are not to be considered as anything but suggestions offered to cooperate with and assist the Contractor and shall not constitute an assumption of responsibility, financial or otherwise, by the Field Representative, the Engineer or the Owner.
- (3) The presence or absence of the Field Representative on the job site will be at the sole discretion of the Owner, and the presence or absence of the Field Representative at any time will not relieve the Contractor of its responsibility to properly perform the Work as required by the Contract.
- (4) The Field Representative will have the authority, but not the obligation, to reject defective materials and equipment if observed; however, the failure of the Field Representative to reject defective materials and equipment or any other Work involving deviations from the Contract will not constitute acceptance of such Work. The Field Representative is not authorized to approve or accept any portion of the

Work or to issue instructions contrary to the Contract; all such approvals, acceptances or instructions shall be in writing and signed by the Engineer or the Owner.

- (5) The Field Representative does not purport to be a safety expert, and is not engaged in that capacity under the Contract or the Engineer's contract with the Owner. The Field Representative does not have either the authority or the responsibility to enforce construction safety laws, rules, regulations or procedures, or to order the stoppage of Work for claimed violations thereof. From time to time, the Field Representative may inform the Contractor of conditions that may constitute safety issues or violations. Such information will be provided solely to cooperate with and assist the Contractor and shall not make the Field Representative or the Engineer responsible for the enforcement of safety laws, rules, regulations or procedures. After receiving information relating to safety issues from the Field Representative, the Contractor shall make its own examination and analysis of the situation reported and take such action, if any, that the Contractor determines to be appropriate. The Field Representative's performance of observation services shall not make the Field Representative responsible for the enforcement of safety laws, rules, regulations or procedures; nor shall it make the Field Representative responsible for construction means, methods, techniques, sequences, or procedures, or for the Contractor's failure to properly perform the Work, all of which are entirely the responsibility of the Contractor.

3.02.3 CONSTRUCTION OBSERVATION AND INSPECTIONS

- (1) All Work required by the Contract, including all materials and equipment to be furnished and the manufacture and preparation thereof shall, at all times, be subject to observation by the Owner's designated representatives, who may, at any time in the performance of their duties, enter upon the Work or the shops and factories where any part of the Work, materials or equipment are being prepared, fabricated or manufactured.
- (2) Observation of Work by the Owner, the Engineer, or the Field Representative shall not relieve the Contractor of its obligation to furnish satisfactory materials and workmanship. Work or materials found unsatisfactory at any time during the life of the Contract, and the applicable warranty periods, guarantees or limitation periods shall be promptly corrected or replaced immediately by the Contractor at its own expense.
- (3) Upon request by the Owner or Engineer, the Contractor shall furnish all tools, labor, equipment and materials necessary to examine any Work that may be completed or in progress, even to the extent of uncovering or taking down portions of completed or covered Work. Work shall be left exposed until examined by the Owner or Engineer, at no additional cost to the Owner. If the Owner or the Engineer determines that the uncovered Work does not comply with the requirements of the Contract, the cost of such examination and the cost of reconstruction and/or repair shall be borne by the Contractor.

- (4) The Contractor shall promptly comply with all directions of the Engineer with reference to correcting any Work or replacing any materials or equipment found to be not in accordance with the Contract. In the event of a dispute, the Contractor may appeal to the Engineer's decision to the Owner in accordance with the Contract, and the Owner's decision shall be final.

3.02.4 EMERGENCY CONTACT LIST

The Contractor shall submit an emergency contact list to the Engineer no later than five calendar days after the date the contract is executed. The list shall include the Contractor's project manager or equivalent, project superintendent, traffic control supervisor, and erosion and sediment control lead, as applicable. The list shall identify a representative with delegated authority to act as the emergency contact on behalf of the Contractor and include one or more alternates. The emergency contact shall be available upon the Engineer's request at other than normal working hours. The emergency contact list shall include 24-hour telephone numbers for all individuals identified as emergency contacts or alternates.

3.02.5 ORAL AGREEMENTS

No oral agreement or conversation with any officer, agent, or employee of the Owner, 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 Owner, unless subsequently put in writing and signed by the Owner.

3.02.6 ELECTRONIC FILES

All Work performed shall be in conformity with the signed Contract Plans and Contract Provisions. If the Contractor requests electronic files, the Engineer may provide the files. The use of the electronic files shall be at the Contractor's sole risk. The Engineer does not warrant the completeness or accuracy of the electronic files and the Engineer assumes no liability for any errors or omissions in the digital data. The Contractor shall be responsible for reviewing and checking the electronic files to ensure that they are suitable for the Contractor's purpose.

3.03 LEGAL RELATIONS AND RESPONSIBILITIES

3.03.1 APPLICABLE LAWS AND REGULATIONS

3.03.1(1) General

The Contractor shall comply with all laws, ordinances, rules and regulations of any authority having jurisdiction in any way relating to the project, including, but not limited to, regulations governing site maintenance, clean-up, air pollution control, noise control, water quality control, surface water control and runoff, tree and vegetation protection, cultural resources and oil and hazardous substance control.

3.03.1(2) Utilities and Similar Facilities

The Contractor shall protect all private and public utilities from damage. Utilities include, among others: telephone lines; cable television and high-speed internet lines; gas; electric power lines; sanitary sewer; sewer; storm sewer and water lines; street lighting and traffic signal and signing systems; and railroad tracks and related equipment.

In accordance with Chapter 19.122 of the Revised Code of Washington, the Contractor shall call the One-Number Locator Service for the field location of underground utilities. If no locator service is available for the area where the project is located, the Contractor shall provide written notice to all owners of utilities known to, or suspected of, having underground facilities within or near all areas of that will be excavated.

If the Work requires removing or relocating one or more utilities, the Contract will assign the task to the Contractor or utility owner. When this task is assigned to the utility owner and that work is not complete before the Contractor begins work, the Contractor shall immediately notify the Engineer in writing.

To expedite the removal or relocation work or to make that work more efficient, the Contractor may ask utility owners to move, remove, or alter their utilities or equipment in ways other than those specified in the Contract. If so, the Contractor shall make the arrangements with the utility owner and pay all costs associated therewith.

The Contractor shall be responsible for all costs required to protect public and private utilities from damage, including the costs of removal and replacement.

3.03.1(3) Site Maintenance

The Contractor shall keep the Work site, staging areas, and Contractor's facilities clean and free from rubbish and debris. Materials and equipment shall be removed from the Work site when they are no longer necessary. Upon completion of the Work and before final acceptance, the Work site shall be cleared of equipment, unused materials, and rubbish and the Work site shall be left in clean and neat condition.

3.03.1(4) State Taxes

The Washington State Department of Revenue has issued special rules on the State sales tax. Section 3-03.1(4) a through Section 3-03.1(4) c are meant to clarify those rules. The Contractor should contact the Washington State Department of Revenue for answers to questions in this area. The Owner 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 3-03.1(4) b describes this exception.

The Owner will pay the retained percentage 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 Owner 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 the Contract or not. Any amount so deducted will be paid into the proper State fund.

a. 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.

b. 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 Owner, retail sales tax on the full contract price. The Owner 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 Owner 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.

c. Services

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

3.03.1(5) Equal Employment Responsibilities

The Contractor shall, at its sole cost and expense, comply with all applicable laws, policies and regulations pertaining to nondiscrimination and equal employment opportunities. The absence of specific provisions or other requirements mandated by state, municipal or federal laws, policies or regulations from these General Conditions shall not excuse the Contractor from compliance with such laws, regulations or policies.

3.03.1(6) Archaeological and Historical Objects

Archaeological or historical objects, such as ruins, human skeletal remains, sites, buildings, artifacts, fossils, or other objects of antiquity that may have significance from a historical or scientific standpoint, which may be encountered by the Contractor, shall not be further disturbed. The Contractor shall immediately notify the Engineer of any such finds.

The Engineer will determine if the material is to be salvaged. The Contractor may be required to stop work in the vicinity of the discovery until such determination is made. The Engineer may require the Contractor to suspend Work in the vicinity of the discovery until salvage is accomplished.

If the Engineer finds that the suspension of Work in the vicinity of the discovery increases or decreases the cost or time required for performance of any part of the Work under the Contract, the Engineer will make an adjustment in payment or the time required for the performance of the work in accordance with Section 3.04.6.

3.03.2 SAFETY MEASURES

All Work under the Contract shall be performed in a safe manner. The Contractor and all subcontractors shall comply with all applicable rules, regulations, and safety standards of the Washington State Department of Labor and Industries and all other federal, state, local and other governmental entities having jurisdiction over the project. The Contractor shall be solely and completely responsible for the conditions of the job site, including the safety of all persons and property during the performance of the Work. This requirement shall apply continuously and not be limited to normal working hours.

The Engineer's review of the Contractor's work plan, safety plan, construction sequences, schedule or performance does not and is not intended to include review or approval of the adequacy of the Contractor's safety measures in, on, or near the job site. The Engineer does not purport to be a safety expert, and is not engaged in that capacity under the Contract. The Engineer has neither the authority nor the responsibility to enforce construction safety laws, rules, regulations, or procedures, or to order the stoppage of Work for claimed violations thereof.

The Contractor shall exercise all required and appropriate precautions to protect all persons and property from injury and damage.

3.03.3 HAZARDOUS MATERIAL

Biological hazards and associated physical hazards may be present at the Work site. The Contractor shall take precautions and perform any necessary Work to provide and maintain a safe and healthful Work site in accordance with all applicable laws. The cost for all Work necessary to provide and maintain a safe Work site shall be included in the Contractor's Proposal, unless the Contract includes provisions to the contrary.

3.03.4 PAYMENT OF WAGES AND RELATED REQUIREMENTS

3.03.4(1) Minimum Prevailing Wage Requirements

- a. The Contract is subject to the minimum prevailing wage and hour requirements of RCW 39.12 and RCW 49.28 (as amended or supplemented). The Contract may list minimum hourly rates for wages for trades or occupations in the locality within the state where such labor is performed as determined by the Industrial Statistician for the Department of Labor and Industries. These rates are for general reference purposes only and may not be current or complete. The Contractor, any subcontractor, or other person doing any Work under the Contract shall not pay any worker less than the applicable current minimum hourly wage rates required by applicable law. Higher wages and benefits may be paid.
- b. The Contractor, any Subcontractor, and all individuals or firms required by RCW 39.12, WAC 296-127 to pay minimum prevailing wages, shall not pay any worker less than the minimum hourly wage rates and fringe benefits required by RCW 39.12. Higher wages and benefits may be paid.
- c. In accordance with WAC 296-127, the applicable prevailing wage rates that are in effect on the date when Proposals are due shall remain in effect for the duration of the Contract. By incorporating prevailing wage rates into the Contract, the Owner does not warrant or imply that the Contractor will find labor available at those rates. The Contractor shall calculate in its Proposal any amounts above the minimums that it will actually have to pay. Further, rates for wages and/or fringe benefits may change while the Contract is in force. If they do, the Contractor shall bear the cost of paying rates above those in effect at time of bid.
- d. If employing labor in a class not listed in the Contract Provisions on State funded projects, the Contractor shall request the Industrial Statistician, Department of Labor and Industries to determine the correct wage and benefits rate.
- e. If employing labor in a class not listed in the Contract Provisions on a federally funded project, the Contractor shall request the U.S. Secretary of Labor to determine the correct wage and benefits rate.

- f. The Contractor shall ensure that any firm (Supplier, Manufacturer, or Fabricator) that falls under the provisions of RCW 39.12 because of the definition “Contractor” in WAC 296-127-010, complies with all the requirements of RCW 39.12.
- g. The Contractor shall be responsible for compliance with the requirements of the RCW 39.12 by all firms (Subcontractors, lower tier subcontractors, Suppliers, Manufacturers, or Fabricators) engaged in any part of the Work necessary to complete the Contract. Therefore, should a violation of this Subsection occur by any firm that is providing Work or materials for completion of the Contract whether directly or indirectly responsible to the Contractor, the Owner will take action against the Contractor, as provided by the provisions of the Contract, to achieve compliance, including, but not limited to, withholding payment on the Contract until compliance is achieved.
- h. The State of Washington prevailing wage rates for this public works project can be found on the following Labor and Industries link: <https://lni.wa.gov/licensing-permits/public-works-projects/prevailing-wage-rates>. The applicable rates should be rates effective on the bid opening date for Journey Level and Apprentice Level in Mason County. A copy of the State of Washington prevailing wage rate determination will also be available for review at the Mason County PUD No. 1 office.

3.03.4(2) Posting Notice Requirements

Notice of intent to pay prevailing wages and prevailing wage rates for the project shall be posted for the benefit of workers. The Contractor shall post the following, together with anything else necessary to comply with all applicable laws and regulations:

- a. One copy of the approved “Statement of Intent to Pay Prevailing Wages” for the Contractor, each subcontractor, and any other firm (Supplier, Manufacturer, of Fabricator) that falls under the provisions of RCW 39.12 because of the definition of “Contractor” in WAC 296-127-010;
- b. One copy of the prevailing wage rates for the project;
- c. The address and telephone number of the Industrial Statistician for the Department of Labor and Industries, along with a statement that complaints and questions about wage rates may be directed there; and

Notice shall be posted at a location readily visible to workers at the job site, or where no field office is established, at a local office. The Contractor shall supply a copy of the Notice to any employee upon request.

3.03.4(3) Apprentices

If employing apprentices, the Contractor shall submit to the Owner written evidence showing:

- a. That each apprentice is enrolled in a program approved by the Washington State Apprenticeship and Training Council;
- b. The progression schedule for each apprentice; and
- c. The established apprentice-journeyman ratios and wage rates in the project locality upon which the Contractor shall base such ratios and rates under the contract. Any worker for whom an apprenticeship agreement has not been registered and approved by the Washington State Apprenticeship and Training Council shall be paid the prevailing hourly rate for journeymen provided in RCW 39.12.021.

3.03.4(4) Required Documents

1. General

All “Statements of Intent to Pay Prevailing Wages”, “Affidavits of Wages Paid” and Certified Payrolls shall be submitted on the State L&I online Prevailing Wage Intent & Affidavit (PWIA) system. Statements of Intent to Pay Prevailing Wages”, and “Affidavits of Wages Paid” shall also be submitted to the Engineer. When requested by the Engineer, Certified Payrolls shall also be submitted to the Engineer.

2. Intents and Affidavits

On forms provided by the Industrial Statistician of State L&I, the Contractor shall submit to the Engineer the following for themselves and for each firm covered under RCW 39.12 that will or has provided Work and materials for the Contract:

- a. The approved “Statement of Intent to Pay Prevailing Wages” State L&I’s form number F700-029-000. The Contracting Agency will make no payment under this Contract until this statement has been approved by State L&I and reviewed by the Engineer.
- b. The approved “Affidavit of Prevailing Wages Paid”, State L&I’s form number F700-007-000. The Contracting Agency will not grant Completion until all approved Affidavit of Wages paid for the Contractor and all Subcontractors have been received by the Engineer. The Contracting Agency will not release to the Contractor any funds retained under RCW 60.28.011 until “Affidavit of Prevailing Wages Paid” forms have been approved by State L&I and all of the approved forms have been submitted to the Engineer for every firm that worked on the Contract.

The Contractor is responsible for requesting these forms from State L&I and for paying any fees required by State L&I.

3. Certified Payrolls

Certified payrolls are required to be submitted by the Contractor for themselves, all Subcontractors and all lower tier subcontractors. The payrolls shall be submitted no less than monthly on State funded projects.

4. Penalties for Noncompliance

The Contractor is advised, if these payrolls are not supplied within the prescribed deadlines, any or all payments may be withheld until compliance is achieved. In addition, failure to provide these payrolls may result in other sanctions as provided by State laws (RCW 39.12.050).

3.03.5 BONDS, INSURANCE AND INDEMNITY OBLIGATIONS

3.03.5(1) Contract Bonds

The successful bidder shall provide an executed Performance Bond and Public Works Payment Bond for the full Contract amount (including sales tax). The Contract Bonds shall:

1. Be on Owner-furnished forms;
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; and
4. Guarantee that the Surety shall indemnify, defend, and protect the Owner 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, materialperson, 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).

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

3.03.5(1.1) Two-Year Guarantee Period

The Contractor shall return to the project and repair or replace all defects in workmanship and material discovered within 2 years after Final Acceptance of the Work. The Contractor shall start work to remedy any such defects within 7 calendar days of receiving Owner's written notice of a defect, and shall complete such work within the time stated in the Owner'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 Owner'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 2 years after acceptance of the corrections by Owner.

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 Owner.

3.03.5(2) Worker's Benefits

- a. The Contractor shall make all payments required for unemployment compensation under RCW Title 50 and for industrial insurance and medical aid required under RCW Title 51. If any payment required by Title 50 or Title 51 is not made when due, the Contractor shall indemnify the Owner with respect to all costs and damages, including attorneys' fees and expenses, associated with such nonpayment. The Owner may retain payments due under Title 50 or Title 51 from any money due to the Contractor and make payment to the appropriate fund.
- b. The Contractor shall include in the various items in its bid Proposal all costs for payment of unemployment compensation and for providing the required insurance coverage(s). The Contractor will not be entitled to any additional payment for: (1) failure to include such costs in the Proposal, or (2) post-Award determinations made by the U.S. Department of Labor, the Washington State Department of Labor and

Industries, or any other agency or entity regarding insurance coverage requirements.

3.03.5(4) Public Liability & Property Damage Insurance

3.03.5(4.1) General Requirements

- A. The Contractor shall procure and maintain insurance described in all subsections in this Section, from insurers with a current A.M. Best rating not less than A – VII and licensed to do business in the state of Washington. The Owner 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.
- B. The Contractor shall keep this insurance in force during the term of the Contract and for 30 days after the Physical Completion Date, unless otherwise indicated.
- C. All insurance coverage required by this section shall be written and provided by “occurrence-based” policy forms rather than by “claims made” forms.
- D. The insurance policies shall contain a “cross liability” provision.
- E. The Contractor’s and all subcontractors’ insurance coverage shall be primary and non-contributory insurance as respects the Owner’s insurance, self-insurance, or insurance pool coverage. Any insurance, self-insurance or self-insured pool coverage maintained by the Owner shall be excess of the Contractor’s insurance and shall not contribute with it.
- F. The Contractor shall provide the Owner and all Additional Insured with written notice of any policy cancellation and the date of effective cancellation within 2 business days of receipt.
- G. The Contractor shall not begin work under the Contract until the required insurance has been obtained and approved by the Owner.
- H. Failure on the part of the Contractor to maintain the insurance as required shall constitute a material breach of Contract, upon which the Owner may, after giving 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 Owner on demand, or at the sole discretion of the Owner, offset against funds due the Contractor from the Owner.
- I. 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.

3.03.5(4.2) Additional Insured

All insurance policies, with the exception of Workers Compensation, shall name the following listed entities as additional insured(s) using the forms or endorsements required herein:

- The Owner and its officers, elected officials, employees, agents, and volunteers;
- Gray & Osborne, Inc.;

The above-listed entities shall be additional insured(s) for the full available limits of liability maintained by the Contractor, irrespective of whether such limits maintained by the Contractor are greater than those required by the Contract, and irrespective of whether the Certificate of Insurance provided by the Contractor pursuant to 3.03.5(4.4) describes limits lower than those maintained by the Contractor.

3.03.5(4.3) Subcontractors

Contractor shall ensure that each subcontractor of every tier obtains and maintains at a minimum the insurance coverages listed in 3.03.5(4.5)A and 3.03.5(4.5)B. Upon request of the Owner, the Contractor shall provide evidence of such insurance.

3.03.5(4.4) Verification of Coverage

The Contractor shall deliver to the Owner a Certificate(s) of Insurance and 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 shall conform to the following requirements:

1. An ACORD certificate or a form determined by the Owner to be equivalent. The certificate or an endorsement form shall indicate the Contractor's insurance is primary and non-contributory.
2. The Contractor shall obtain endorsement forms CG 2010 10 01, CG 2032 07 04 and CG 2037 10 01 or the equivalent of each, naming the Owner and all other entities listed in 3-03.5(4.2) as Additional Insured(s) and showing the policy number. If the Contractor is unsuccessful in securing these endorsements after exerting commercially reasonable efforts, the Contractor shall obtain other endorsements providing equivalent protection to the Additional Insured. Commercially reasonable efforts shall be evidenced by a signed statement by the Contractor's insurance broker indicating that endorsement forms CG 2010 10 01, CG 2032 07 04 and CG 2037 10 01 are not available and the endorsements submitted provide equivalent protection to the Additional Insured.
3. Any other amendatory endorsements to show the coverage required herein.
4. A notification of coverage enhancements on the Certification of Insurance shall not satisfy these requirements; actual endorsement must be submitted.

Upon request, the Contractor shall forward to the Owner a full and certified copy of the insurance policy(s). If Builders Risk Insurance is required on this Project, a full and certified copy of that policy is required when the Contractor delivers the signed Contract for the Work.

3.03.5(4.5) 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 shall be disclosed and are subject to approval by the Owner. The cost of any claim payments falling within the deductible shall be the responsibility of the Contractor.

3.03.5(4.5)A Commercial General Liability

Commercial General Liability insurance shall be written on coverage forms at least as broad as ISO occurrence form CG 00 01, including but not limited to liability arising from premises, operations, stop gap liability, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract. There shall be no exclusion for liability arising from explosion, collapse or underground property damage.

The Commercial General Liability insurance shall be endorsed to provide a per project general aggregate limit, using ISO form CG 25 03 05 09 or an equivalent endorsement.

Contractor shall maintain Commercial General Liability Insurance arising out of the Contractor’s completed operations for at least 3 years following Substantial Completion of the Work.

Such policy must provide the following minimum limits:

- \$1,000,000 Each Occurrence
- \$2,000,000 General Aggregate
- \$2,000,000 Products & Completed Operations Aggregate
- \$1,000,000 Personal & Advertising Injury, each offence
- \$1,000,000 Stop Gap/Employers’ Liability

3.03.5(4.5)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) shall provide the following minimum limit:

- \$1,000,000 combined single limit each accident

3.03.5(4.5)C Workers' Compensation

The Contractor shall comply with Workers' Compensation coverage as required by the Industrial Insurance laws of the state of Washington.

3.03.5(4.5)D Excess or Umbrella Liability

The Contractor shall provide Excess or Umbrella Liability coverage at limits of \$2 million per occurrence and annual aggregate. This excess or umbrella liability coverage shall apply, at a minimum, to both the Commercial General and Auto insurance policy coverage and employers liability.

This requirement may be satisfied instead through the Contractor's primary Commercial General and Automobile Liability coverage, or any combination thereof.

3.03.5(4.5)I Marine Pollution

If this Contract is near or on water, 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

3.03.5(4.5)J Pollution Liability

If this Contract includes work with lead based paint, materials containing asbestos or transportation of hazardous materials, 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 any one or more of the following:

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

All entities listed under 3.03.5(4.2) 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 limits:

\$1,000,000 each loss and annual aggregate

3.03.5(4.5)K Professional Liability

If the Contract requires engineering design services, the Contractor and/or its Subcontractor(s) 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 shall 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 insurance is 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.

3.03.5(5) Indemnity and Hold Harmless

- a. To the fullest extent permitted by law and subject to the limitations of RCW 4.24.115, the Contractor shall defend, indemnify and hold harmless the Owner and the Engineer and their appointed and elective officers, agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorneys' fees and expenses arising out of or resulting from the negligent performance of the Work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom, and (2) is caused by any negligent act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable. Provided, however, that when any such claim, damage, loss or expense arises from the concurrent negligence of (1) the Owner, or anyone for whose acts it may be liable, and (2) the Contractor, or anyone for whose acts it may be liable, it is expressly agreed that the Contractor's obligations of defense and indemnity under this section shall be effective only to the extent of the Contractor's negligence and those for whose negligence the Contractor is responsible. This obligation of indemnity shall not extend to claims, losses or expenses arising from the sole negligence of the Owner, its appointed or elected officials, agents or employees.
- b. In any and all claims against the Owner or the Engineer or any of their agents or employees by any employee of the Contractor, any 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 any Subcontractor under workmen's

compensation acts, disability benefit acts or other employee benefit acts, it being the expressed intent of the parties that Contractor herein specifically waives any immunity granted under the State Industrial Insurance Law, RCW Title 51. **THIS WAIVER HAS BEEN SPECIALLY NEGOTIATED BY THE PARTIES, WHO HAVE ACKNOWLEDGED SAME BY AFFIXING THEIR SIGNATURES TO THE PROPOSAL FORM.**

3.03.5(6) Patent Royalties & Process Fees

The Contractor shall be responsible for all costs arising from the use of patented devices, materials, or processes used in or incorporated in the Work. The Contractor agrees to indemnify, defend, and save harmless the Owner from all claims and damages, in any way relating to the use of patented devices, materials, or processes used in or incorporated in the Work.

3.03.6 METHOD OF SERVING NOTICE

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, shall be in paper format, hand delivered or sent via mail delivery service to the Owner. Electronic formats such as emails or electronically delivered copies of correspondence will not constitute such notice and will not comply with the requirements of the Contract.

3.04 PROSECUTION AND PROGRESS OF THE WORK

3.04.1 QUALITY OF WORK

3.04.1(1) Workmanship

- a. The Contractor represents that it is fully experienced and possesses all the necessary capital, facilities and expertise to perform all of the Work, and hereby guarantees that all of the Work performed by it under the Contract will be of the highest quality and done in a workmanlike fashion in strict accordance with the requirements of the Contract.
- b. The Contractor shall at all times employ skilled workmen and use skilled Subcontractors in the performance of the Work. When required in writing by the Owner or the Engineer, the Contractor or its Subcontractors shall remove from the Work site any person or Subcontractor who is, in the opinion of the Owner or the Engineer, not competent, not qualified, disorderly, or otherwise unsatisfactory and shall not again employ such discharged person or Subcontractor on the Work, except with the prior written consent of the Owner. Discharge of any person or Subcontractor shall not be the basis of any claim for compensation or damages against the Owner or the Engineer.
- c. All Work performed under the Contract shall be of first quality workmanship throughout, with the Work complete and in full working order upon completion.

- d. Except when otherwise expressly specified in the Contract, the Contractor shall design, survey, layout and be responsible for all methods, materials and equipment used in performing the Work.
- e. If, at any time, the Contractor's workforce (including Subcontractors), in the opinion of the Owner and/or the Engineer, shall be inadequate for maintaining the necessary progress required to complete the Work within the Contract Time, the Contractor shall, if so required by the Owner and/or the Engineer, increase the workforce or equipment to such an extent as to give reasonable assurance of compliance with the Work schedule. The failure of the Owner and/or the Engineer to make such demand shall not relieve the Contractor of its obligation to perform the Work in accordance with the requirements of the Contract. The Contractor alone shall be responsible for the safety, efficiency and adequacy of its activities, construction methods and the rate of progress required by the Contract.

3.04.1(2) Contractor's Supervisory and Site Personnel

- a. The Contractor shall assign sufficient supervisory personnel to ensure the faithful prosecution of the Work and shall have adequate supervisory personnel present at the Work site who are either employees of the Contractor or duly authorized representatives designated in writing to the Owner and/or the Engineer. The Contractor shall at all times maintain at the Work site a complete copy of the Contract Provisions, Contract Plans, and record drawings of the Work that has been completed.
- b. The Contractor shall at all times have at least one duly authorized supervisory representative at the Work site who shall be fully authorized to make binding decisions on behalf of the Contractor with respect to the Work. If the Contractor's duly authorized supervisory representative at the Work site will be absent from the Work site for more than four hours, he/she shall designate an assistant who possesses the same authority and so inform the Owner and the Field Representative, if applicable.

3.04.2 MATERIALS AND EQUIPMENT

- (1) Materials and equipment furnished and installed shall be manufactured, fabricated or constructed to meet all applicable safety requirements. All material and equipment supplied by the Contractor and incorporated in the Work shall be of new manufacture, free from defects and in strict compliance with the requirements of the Contract. When required by the Owner, a certificate from the manufacturer or other responsible supplier shall be supplied attesting to this fact.
- (2) All tools and equipment used for construction operations shall be of the size and type suitable for the Work and shall be kept in safe and good working condition at all times.

- (3) The Contractor shall, whenever required during the progress of the Work and after completion of the Work, furnish proof acceptable to the Owner that all items of equipment and all materials installed equal or exceed all requirements specified in the Contract.
- (4) The Contractor shall use all means possible to protect materials and equipment from damage or degradation of any kind before, during and after installation.
- (5) The Contractor shall replace any materials or equipment damaged during the performance of the Work to the approval of the Owner and the Engineer. The cost of replacing damaged materials and equipment shall be borne by the Contractor.

3.04.3 SPECIFICATION OF PARTICULAR MATERIALS AND EQUIPMENT

- (1) Within the Contract, certain items are specified by brand, style, trade name, or manufacturer in order to set forth a standard of quality, and/or preference by the Owner. Unless specifically noted otherwise, it is not the intent of the Contract to exclude other processes or materials of a type and quality equal to those designated.
- (2) The term “or equal” as used in the Contract does not mean that the Contractor’s substitution of material or equipment will necessarily be approved as equal by the Engineer. If the Contractor desires to substitute material or equipment on the basis that it is equal to that specified, the Contractor shall submit a written request to the Engineer to substitute the material or equipment. The Contractor shall not use or incorporate such material or equipment into the Work until the Contractor has received written approval from the Engineer.
- (3) If the Contractor proposes substitutions, the Engineer will record all time used to evaluate each proposed substitution. If an approved substitution requires revisions to the Contract Documents, the Engineer will record all time to accomplish the revisions. Whether or not the Engineer approves a proposed substitution all direct and indirect cost to evaluate the proposed substitution shall be deducted from amounts due or to become due to the Contractor.
- (4) No additional compensation or extension of time will be allowed the Contractor for any changes required to incorporate substituted materials or equipment.

3.04.4 STORAGE

3.04.4(1) On-Site Storage

The Contractor shall store all equipment and materials in a safe and suitable place in accordance with the manufacturer’s recommendations. Materials and equipment shall be covered or wrapped to protect them from moisture, dust and deterioration, as required or necessary. All on-site storage areas shall be approved in advance by the Owner and the Engineer.

3.04.4(2) Off-Site Storage

The Contractor may be required to provide offsite storage of equipment and materials to enable construction to occur at the Work site. The Contractor has full responsibility to secure all offsite storage areas, if needed, and shall include the costs for providing such storage areas in the bid Proposal for the individual equipment and material items requiring off-site storage. All off-site storage areas shall be enclosed or fenced and be secure.

3.04.5 DEFECTIVE MATERIALS, EQUIPMENT AND WORKMANSHIP

- (1) Materials, equipment, or workmanship which, in the opinion of the Owner or the Engineer, does not conform to the Contract or are in any other way unsatisfactory or unsuited to the purpose for which they are intended may be rejected. The Contractor shall remove from the Work site without delay, all rejected materials, equipment and work, and shall promptly replace the same in strict conformity with the requirements of the Contract. Unsatisfactory materials, equipment and workmanship may be rejected at any time, notwithstanding any previous testing, inspection or acceptance of such materials, equipment or workmanship, or inclusion thereof in any previously issued progress estimates.
- (2) If the Contractor fails to correct defective Work, equipment or materials, the Owner shall have the right to exercise any of the following options or any combination thereof:
 - a. The Owner may replace the defective Work, materials or equipment by purchase from or contract with any other parties at the expense of the Contractor, and in this event, the Owner shall be entitled without compensation to the Contractor, to the use of the defective Work or equipment for such reasonable time as is necessary to enable Owner to replace such defective Work, materials or equipment.
 - b. The Owner may elect to accept the defective Work, materials or equipment and issue a Change Order reflecting a credit against the contract price, computed under the terms of the Contract in an amount to be determined by the Engineer, which amount shall reflect the actual value to the Owner of the accepted Work.
 - c. Upon receipt of notice from the Owner of any defects in material, equipment or workmanship which appear within a two-year period following the Substantial Completion Date, or within any other warranty or guarantee period required by the Contract or provided by a manufacturer or supplier, the Contractor shall promptly and with the least possible delay and inconvenience to the Owner, repair or replace such defective workmanship, material or equipment without expense to the Owner.
 - d. The Contractor shall be responsible for the full cost of correcting defective Work and complying with warranties and guarantees as required by the

Contract. Direct or indirect costs, including administrative and engineering, incurred by the Owner 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 Owner 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.

- e. All warranties, guarantees, and other obligations to correct work that does not comply with the Contract are material requirements of the Contract. The performance of all warranties, guarantees and other obligations shall be secured by the Performance Bond and the Public Works Payment Bond submitted by the Contractor at the time the Contract is signed.

3.04.6 CHANGES IN THE WORK

- (1) The Owner or the Engineer may, at any time, without notice to the Performance Bond or Public Works Payment Bond sureties, by written order designated or indicated to be a Change Order or Change Directive, make any change, including modifications to, additions to or deletions from the Work including, but not limited to, changes:
 - a. To the Contract Provisions and Contract Plans;
 - b. To quantities or performance of the Work;
 - c. To Owner-furnished facilities, equipment, materials, services or the Work site; or
 - d. To the schedule for the Work or the Contract Time.
- (2) A Change Order is an amendment to the Contract, which signifies changes in the scope of the Work, the Contract Time, and/or the Contract price. A Change Order shall be the complete expression of the agreement between the Owner and the Contractor. No claims or entitlement to and equitable adjustment or changes to the Contract Time and/or Contract Price will be allowed for alleged verbal or oral agreements or directives.
- (3) The Engineer will issue a written change order for any change. If the Engineer determines that the change increased or decreased the Contractor's costs or time to do any of the Work, the Engineer will make an equitable adjustment to the Contract. The equitable adjustment will be by agreement with the Contractor. However, if the parties are unable to agree, the Engineer will determine the amount of the equitable adjustment in accordance with Section 3.04.6(7) and adjust the time as

the Engineer deems appropriate. Extensions of time will be evaluated in accordance with Section 3.04.15(2).

The Contractor shall proceed with the Work upon receiving:

1. A written change order approved by the Owner; or
2. An oral order from the Engineer before actually receiving the written change order.

Within 14 calendar days of delivery of the change order the Contractor shall endorse and return the change order, request an extension of time for endorsement or respond in accordance with Section 3.04.8. The Owner may unilaterally process the change order if the Contractor fails to comply with these requirements. Changes normally noted on field stakes or variation from estimated quantities, except as provided in Section 3.04.6(8), will not require a written change order. These changes shall be made at the unit prices that apply. The Contractor shall respond immediately to changes shown on field stakes without waiting for further notice.

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

- (4) All Change Orders will be prepared by the Owner or Engineer and executed in triplicate with one copy to the Owner, one to the Contractor, and one retained by the Engineer.
- (5) If the Contractor encounters any circumstances during the performance of the Work that the Contractor contends creates any entitlement to a change in the Contract Time, the Contract Price, or both, the Contractor shall immediately provide written notice to the Engineer. Within 10 calendar days after providing written notice, the Contractor shall provide a written request to the Engineer for a change to the Contract Time and/or Contract Price and provide detailed information supporting the request, including cost and schedule information.
- (6) No claim by the Contractor shall be allowed if the terms of this Section 3.04.6 are not strictly followed. In the event of any non-compliance, the Contractor shall be conclusively determined to have waived any claim or entitlement to an adjustment of the Contract Time or the Contract Price.
- (7) The cost to be included in an adjustment for any changes to the Work, adjustment of the Contract Time or Contract Price and any equitable adjustment or entitlement related to the Work or the Contract shall meet the notice provisions of Section 3.04.6, and will be determined strictly by one or a combination of the following methods:
 - a. Contract unit bid prices previously agreed upon; or

- b. If there are no unit bid prices, an agreed lump sum; or
- c. If the amount of the adjustment cannot be agreed upon in advance or in the manner provided in subparagraph a or b above, the cost will be determined by the actual cost of:

- 1. Labor including working foremen. Labor rates will only include the basic wage and fringe benefits, the current rates for Federal Insurance Compensation Act (FICA), Federal Unemployment Tax Act (FUTA) and State Unemployment Tax Act (SUTA), and the company's present rates for medical aid and industrial insurance premiums;
- 2. Materials incorporated permanently into the Work;
- 3. The ownership or rental cost of equipment during the time of use on the extra work. Equipment rates shall be as set forth in the then current AGC/WSDOT Equipment Rental Agreement. These rates shall be full compensation for all costs incidental to furnishing and operating the equipment. The Contractor shall submit copies of the applicable portions of the AGC/WSDOT Equipment Rental Agreement to the Engineer; plus
- 4. Overhead and Profit as follows:

For Work performed by the Contractor, an amount to be agreed upon but not to exceed 15 percent of the labor, material, and equipment cost agreed to by the Engineer as compensation for supervision, small tools, provisions for safety, home office and field overhead, profit and other general conditions expenses, including, but not limited to, insurance, bond and business and occupation taxes.

For Subcontractor Work, the Subcontractor will be allowed an amount to be agreed upon but not to exceed 15 percent of the labor, material, and equipment cost agreed to by the Engineer as compensation for supervision, small tools, provisions for safety, home office and field overhead, profit and other general conditions expenses, including, but not limited to, insurance, bond and business and occupation taxes. The Contractor will be allowed an additional markup of 10 percent to compensate the Contractor for all administrative costs, including home office and field overhead, profit, bonding, insurance, business and occupation taxes and any other costs incurred.

In no case will the total fixed fee for the Contractor and all Subcontractors of all tiers exceed 30 percent.

- (8) 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 bid 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 bid quantity, and that bid item represents 10 percent or more of the total original contract price. In that case, payment for Contract Work may be adjusted as described herein.

The adjusted final quantity shall be determined by starting with the final accepted quantity measured after all Work under an item has been completed. From this amount, subtract any quantities included in additive change orders accepted by both parties. Then, to the resulting amount, add any quantities included in deductive change orders accepted by both parties. The final result of this calculation shall become the adjusted final quantity and the basis for comparison to the original Proposal quantity.

- a. **Increased Quantities.** Either party to the Contract will be entitled to renegotiate the price for that portion of the adjusted final quantity in excess of 1.25 times the original Proposal quantity, if 10 percent or more of the original contract price. The price for excessive increased quantities will be determined by agreement of the parties, or, where the parties cannot agree, the price will be determined by the Engineer based upon the actual costs to perform the Work, including reasonable markup for overhead and profit. The final price will be determined by the Engineer.
- b. **Decreased Quantities.** Either party to the Contract will be entitled to an equitable adjustment if the adjusted final quantity of Work performed is less than 75 percent of the original Bid quantity, if 10 percent or more of the original contract price. The Contractor shall submit the documentation to support the equitable adjustment to the Engineer. The equitable adjustment shall be based upon and limited to three factors:
 1. Any increase or decrease in unit costs of labor, materials or equipment, utilized for Work actually performed, resulting solely from the reduction in quantity;
 2. Changes in production rates or methods of performing Work actually done to the extent that the nature of the Work actually performed differs from the nature of the Work included in the original plan; and
 3. An adjustment for the anticipated contribution to unavoidable fixed cost and overhead from the units representing the difference between the adjusted final quantity and 75 percent of the original Plan quantity.

The following limitations shall apply to renegotiated prices for increases and/or equitable adjustments for decreases:

1. The equipment rates shall be actual cost but shall not exceed the rates set forth in the AGC/WSDOT Equipment Rental Agreement.
2. No payment will be made for extended or unabsorbed home office overhead and field overhead expenses to the extent that there is an unbalanced allocation of such expenses among the Contract Bid items.
3. No payment for consequential damages or loss of anticipated profits will be allowed because of any variance in quantities from those originally shown in the Proposal form, Contract Provisions, and Contract Plans.
4. The total payment (including the adjustment amount and unit prices for Work performed) for any item that experiences an equitable adjustment for decreased quantity shall not exceed 75 percent of the amount originally Bid for the item.

If the adjusted final quantity of any item does not vary from the quantity shown in the Proposal by more than 25 percent, then the Contractor and the Owner agree that all Work under that item will be performed at the original Contract unit price.

When ordered by the Engineer, the Contractor shall proceed with the Work pending determination of the cost or time adjustment for the variation in quantities.

The Contractor and the Owner agree that there will be no cost adjustment for decreases if the Owner has entered the amount for the item in the Proposal form only to provide a common Proposal for Bidders.

3.04.7 DIFFERING SITE CONDITIONS

The Contractor shall promptly, and before such conditions are disturbed, notify the Engineer in writing of: (1) pre-existing subsurface or latent physical conditions at the Work site that differ materially from those indicated in the Contract Documents, or (2) pre-existing unknown physical conditions at the Work site, of an unusual nature, that differ materially from those ordinarily encountered and generally recognized as inherent in the Work of the character required by the Contract. The Engineer shall be given an opportunity to examine such conditions in order to advise the Owner of possible modifications to the Work to mitigate such conditions. If the Engineer determines that conditions are materially different and cause a material increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, an equitable adjustment shall be made in the Contract Time and/or Contract price in accordance with other

applicable provisions of the Contract relating to changes in the Work. Failure of the Contractor to give notice of such conditions at the time of discovery shall constitute a waiver of any claim for an equitable adjustment. Any such adjustments to the Contract Price shall be computed strictly limited to amounts provided under paragraph 3.04.6.

3.04.8 PROTEST BY THE CONTRACTOR

If the Contractor disagrees with anything in a Change Order or a written directive, or with any interpretation or determination by the Engineer, the Contractor shall:

- a. Immediately submit a signed written notice of protest to the Engineer before doing the Work;
- b. Supplement the written protest within 14 calendar days with a written statement and supporting documents providing the following:
 1. The date and nature of the protested order, direction, instruction, interpretation or determination;
 2. A full discussion of the circumstances which caused the protest, including names of persons involved, time, duration, and nature of the Work involved and a review of the Plans and Contract Provisions referenced to support the protest;
 3. The estimated dollar cost, if any, of the protested Work and a detailed breakdown showing how that estimate was determined; and
 4. An analysis of the progress schedule showing the schedule change or disruption if the Contractor is asserting a schedule change or disruption; and
 5. If the protest is continuing, the information required above shall be supplemented upon request by the Engineer until the protest is resolved.

The Contractor shall keep detailed and complete records of extra costs and schedule impacts to Contract Time that in any way relate to a protest. The Contractor shall allow the Engineer to have access to all documents and records needed for evaluating the protest.

The Engineer will evaluate all protests that comply with this Section. If the Engineer determines that a protest is valid, the Engineer will adjust the Contract Price and/or the Contract Time by an adjustment in accordance with Section 3.04.6 and 3.04.15(2).

During the time when any protest is pending, the Contractor shall proceed promptly with the Work, as the Engineer orders in writing.

The Contractor's failure to submit a protest in strict accordance with the requirements of this Section shall constitute a waiver of any claim for an adjustment to the Contract Time, the Contract Price, or other relief.

3.04.9 SUBCONTRACTORS AND SUBCONTRACTS

3.04.9(1) Contractor Responsibility

Nothing contained in the Contract shall create any contractual or other relationship between the Owner and/or the Engineer and any Subcontractor or sub-subcontractor, and no performance undertaken by any such Subcontractor or sub-subcontractor shall, under any circumstances, relieve the Contractor of its obligations and responsibilities under the Contract.

Prior to subcontracting any Work, the Contractor shall verify that every first tier Subcontractor meets the responsibility criteria stated below at the time of subcontract execution. The Contractor shall include these responsibility criteria in every subcontract, and require every Subcontractor to:

1. Possess any electrical contractor license required by 19.28 RCW or elevator contractor license required by 70.87 RCW, if applicable;
2. Have a certificate of registration in compliance with Chapter 18.27 RCW;
3. Have a current State unified business identifier number;
4. If applicable, have:
 - a. Industrial insurance coverage for the bidder's employees working in Washington (Title 51 RCW);
 - b. An employment security department number (Title 50 RCW);
 - c. A state excise tax registration number (Title 82 RCW).
5. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or RCW 39.12.065(3);
6. Verify these responsibility criteria for every lower tier subcontractor at the time of subcontract execution; and
7. Include these responsibility criteria in every lower tier subcontract.

3.04.9(2) Contractor Work Performance Requirement

Work done by the Contractor's own organization shall account for at least 30 percent of the awarded Contract price.

3.04.9(3) Approval of Subcontractors

The Contractor shall not subcontract Work unless the Engineer approves in writing. Each request to subcontract shall be on the form the Engineer provides. If the Engineer requests, the Contractor shall provide proof that the subcontractor has the experience, ability, and equipment the work requires. The Contractor shall require each subcontractor to comply with Section 3.03.4 and to furnish all certificates and statements required by the contract. Approval of a Subcontractor by the Owner shall not relieve the Contractor or Subcontractor of any obligations or responsibilities under the Contract. Any delays or other impacts caused by the failure of the Contractor to provide required information and obtain approval of any Subcontractor in a timely manner will not be considered as justification for additional compensation or an extension of the Contract Time.

3.04.9(4) Subcontracts

Upon approval of Subcontractors by the Owner, the Contractor shall, if requested, provide the Owner with complete copies of all subcontracts entered into between the Contractor and any Subcontractor. Providing requested subcontracts to the Owner shall be a condition precedent to the Owner's obligation to make any progress payment to the Contractor.

3.04.9(5) Incorporation of Contract

Every subcontract entered into by the Contractor shall expressly bind each Subcontractor to all of the terms and conditions of the Contract, which the Contractor shall incorporate into each subcontract by reference.

3.04.9(6) Replacement of Subcontractors

Subject to the requirements of state and/or federal agencies having jurisdiction over MBE/WBE/DBE requirements applicable to the Work, should it become impossible for a Subcontractor to perform the Subcontractor's intended work, the Contractor shall submit the information required above for an alternate Subcontractor at least 10 days prior to the time that the Subcontractor is scheduled to begin work. The failure of any Subcontractor to perform its portion of the Work in a timely or workmanlike fashion is the sole responsibility of the Contractor.

3.04.10 MUTUAL RESPONSIBILITY OF CONTRACTORS

The Owner reserves the right to perform other work on or near the Work site using its own forces and/or other contractors. The Contractor shall take all reasonable steps to coordinate its performance of the Work with the Owner and/or such other contractors and subcontractors. If, through acts of commission or omission on the part of the Contractor, any other contractor or any subcontractor shall suffer loss or damage with respect to the other work being performed by the Owner, the Contractor agrees to promptly settle with such other contractor or subcontractor by agreement or other dispute resolution process. The Contractor agrees to indemnify and hold harmless the Owner and the Engineer from all claims asserted against and liability incurred by the Owner or the Engineer resulting from disputes between the Contractor and any other contractor or any subcontractor or material supplier. The indemnification rights of the Owner and the Engineer include expenses such as, but not limited to, salaries/wages of employees and all other expenses

relating to any mediation, litigation, or arbitration, including costs, consulting fees and attorneys' fees. If such other contractor or subcontractor shall assert any claim against the Owner on account of any damage alleged to have been sustained by an act or omission of the Contractor or anyone for whose acts it may be liable, the Owner or the Engineer shall notify the Contractor, which shall defend, indemnify and save harmless the Owner and the Engineer against such claim.

The coordination of the Work with other work by the Owner shall be taken into account by the Contractor as part of its site investigation obligations under Section 2.01.4, and all costs thereof shall be borne by the Contractor as part of the contract price for the Work.

3.04.11 RISK OF LOSS

The Contractor shall have all risk of loss for all Work in progress, all materials, all equipment and all other items in any way relating to the Work through theft, fire, other casualty, act of God, or any other cause until the Contract Completion Date.

3.04.12 MEASUREMENT AND PAYMENT

3.04.12(1) General

The Contract price for the Work, whether lump sum or unit prices, shall constitute full compensation for furnishing all facilities, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete all items of the Work in accordance with the Contract, notwithstanding that minor or incidental features of the Work may not be shown on the Contract Plans or Contract Provisions.

3.04.12(2) Measurement

Measurement for all items shall be as specified in the Contract for unit price and lump sum price items.

3.04.12(3) Payment

Payment for all of the Work will be made at the lump sum or unit contract price as set forth in the Contract. Payment of the contract price shall constitute full compensation for the complete performance of all of the Work.

3.04.12(4) Access to Books and Records

The Contractor shall, whenever so requested, give the Owner and/or the Engineer access to all invoices, bills of lading and other documents relating to the Work. The Contractor shall, without charge, provide personnel and measures and scales with adequate capacity for measuring or weighing any materials or other items paid for on a unit price basis.

3.04.12(5) Progress Payment Estimates

Progress payment estimates shall be prepared by the Engineer and reviewed by the Contractor and will be submitted with the Engineer’s recommendation to the Owner for its approval on the first day of the month for all Work completed through the 26th day of the preceding month, unless otherwise agreed upon by the Owner, the Engineer and the Contractor. The Engineer will prepare progress payment estimates as accurately as available information permits. The Owner will make no payment under the Contract for the Work performed until the “Statement of Intent to Pay Prevailing Wages,” in accordance with RCW 39.12.040, is submitted to the Engineer, including Subcontractor wage rates. In general, each progress payment will be based upon the payment schedule and the value of Work performed during the preceding pay period. Before the final progress payment estimate is prepared, all quantities will be reviewed by the Engineer.

3.04.12(6) Payment for Materials on Hand

The Owner may reimburse the Contractor for 90 percent of the invoice amount of materials and equipment purchased before their incorporation into the work if properly stored on or near the Work site. Invoices for equipment and materials will be verified and approved by the Engineer. Each invoice shall be sufficiently detailed to enable the Engineer to determine actual costs. Payment for materials on hand shall not exceed the total contract cost of the contract item. Payment will not be made for granular materials, forming materials, consumables, nails, tie wire, etc. Payment will not be made for materials for any invoice that is less than \$2,000.00 or for freight bills and similar items. Payment for equipment or materials on hand shall not constitute acceptance of the equipment or materials. Equipment and materials will be rejected if found to be faulty, even if payment for it has been made.

3.04.12(7) Payments Withheld

The Engineer may decide not to recommend approval of all or a portion of a progress estimate, and/or the Owner may decide to withhold from a progress estimate an amount sufficient to protect the Owner from loss because of:

- a. Defective Work not remedied;
- b. Third-party claims or reasonable evidence indicating the probability that a third-party claim will be asserted;
- c. Failure of the Contractor to make timely and proper payments to Subcontractors or for labor, materials or equipment;
- d. Reasonable evidence that the Work cannot be completed for the unpaid balance of the contract price;
- e. Damage to the Owner or another contractor;

- f. Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance of the contract price will not be adequate to cover actual or liquidated damages for the anticipated delay;
- g. Repeated failure by the Contractor to comply with the directions of the Owner or the Engineer or to carry out the Work in accordance with the Contract;
- h. Other appropriate reasons necessary to protect the Owner.

3.04.12(8) Payment Upon Correction of Deficiencies

When the reason or reasons for withholding payment are resolved, payment will be made for amounts previously withheld.

3.04.12(9) Final Payment

After final inspection (Section 3.04.16(2)) of the Work and a determination by the Engineer that the Physical Completion Date has been achieved, the balance of the Contract price due to the Contractor will be paid based upon the final estimate by the Engineer and presentation of a Final Contract Voucher Certification signed by the Contractor. The Final Contract Voucher Certification shall be deemed to be a release of all claims of the Contractor unless a claim is filed in accordance with the requirements of Section 3.05 and is expressly excepted from release in the Contractor's Final Contract Voucher Certification. The date the Owner signs the Final Contract Voucher Certification constitutes the Contract Completion Date in accordance with Section 3.04.16(3).

If the Contractor fails, refuses, or is unable to sign and return the Final Contract Voucher Certification or any other documentation required in order to achieve the Contract Completion Date, the Owner reserves the right to establish a completion date (for the purpose of meeting the requirements of RCW 39.08 and RCW 60.28) and unilaterally accept the Work. Unilateral final acceptance will occur only after the Contractor has been provided the opportunity, by written request from the Engineer, to voluntarily submit such documents. If voluntary compliance is not achieved, formal notification of the impending establishment of a completion date and unilateral final acceptance will be provided by certified letter from the Owner to the Contractor, which will provide 30 calendar days for the Contractor to submit the necessary documents. The 30 calendar day period will begin on the date the certified letter is received by the Contractor. The date on which the Owner unilaterally signs the Final Contract Voucher Certification shall constitute the Contract Completion Date under Section 3.04.16(3). The Owner shall have the right to unilaterally establish a Contract Completion Date when either (1) the Physical Completion Date for the Work has been achieved in accordance with Section 3.04.16(2), or (2) the Owner terminates the contract in accordance with Section 3.07. Unilateral establishment of the Contract Completion Date by the Owner shall not in any way relieve the Contractor of any liability for failing to comply with the Contract or from responsibility for compliance with all federal, state, tribal, or local laws, ordinances, and regulations that affect the Work.

Payment to the Contractor of partial or final payment estimates and retained percentages shall be subject to applicable laws.

3.04.13 WORK HOURS

Except in the case of emergency or unless otherwise approved by the Owner, 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.

3.04.14 CONTRACT TIME

The Contract Time shall begin on the first working day following the 10th calendar day after the issuance of the written Notice to Proceed or the first day on which the Contractor begins to perform Work on the site, whichever occurs first. Time is of the essence of the Contract. All of the Work shall be completed within the time limits set forth in the Contract, and the Contractor's unexcused failure to do so shall result in the assessment of liquidated damages as provided in the Contract.

The Contractor shall complete all of the physical Work within the number of calendar days that are specified as the Contract Time. Every day will be counted as a calendar day.

Each calendar day shall be charged to the Contract Time as it occurs until the physical completion date. If requested by the Contractor in writing, the Engineer will provide the Contractor with a weekly statement that shows the number of calendar days: (1) charged to the Contract Time the week before; (2) specified for the Contract Time; and (3) remaining to achieve the physical completion date. If the Contractor disagrees with any statement issued by the Engineer, the Contractor shall submit a written protest within 10 calendar days after the date of the statement. The protest shall be sufficiently detailed to enable the Engineer to ascertain the basis for the dispute and amount of time disputed. Any statement that is not protested by the Contractor as required in this Section shall be deemed as having been accepted as correct.

3.04.15 CONSTRUCTION SCHEDULE

3.04.15(1) Progress Schedule

- a. The Contractor shall submit to the Engineer one electronic copy of a progress schedule no later than at the preconstruction conference, or some other mutually agreed upon submittal time. The schedule shall be a critical path method (CPM) schedule, bar chart, or other standard schedule format unless otherwise specified in the Technical Specifications. Regardless of which format is used, the schedule shall identify the critical path. The Engineer will evaluate the schedule and return the schedule for corrections. No progress payments will be made until the required progress schedules have been submitted in a form acceptable to the Engineer.
- b. Scheduling terms and practices shall conform to the standards established in Construction Planning and Scheduling, Second Edition, published by the Associated General Contractors of America. Except for Weekly Look-Ahead Schedules, all schedules shall meet these general requirements, and provide the following information:

- i. Show the construction start date.
- ii. Include all activities necessary to physically complete the project.
- iii. Show the planned order of Work activities in a logical sequence.
- iv. Show the durations of Work activities in working days as defined in Section 3.04.13 and 3.04.14.
- v. Show activities in durations that are reasonable for the intended Work.
- vi. Define activity duration in sufficient detail to evaluate the progress of individual activities on a daily basis.
- vii. Show the Substantial and Physical Completion of all Work within the Contract Time.

Total float belongs to the project and shall not be for the exclusive benefit of any party. If the Engineer determines that the Progress Schedule or any necessary Schedule Update does not provide the required information, then the schedule will be returned to the Contractor for correction and resubmittal.

- c. Each week the Work is performed, the Contractor shall submit a Weekly Look-Ahead Schedule showing the Contractor's and all the Subcontractors' proposed Work activities for the next two weeks. The Weekly Look Ahead Schedule shall include the description, duration and sequence of Work, along with the planned hours of Work. This schedule may be network schedule, bar chart, or other standard schedule format. The Weekly Look-Ahead Schedule shall be submitted to the Engineer by the mid-point of the week preceding the scheduled Work or some other mutually agreed upon submittal time.
- d. The Engineer may request a Schedule Update when any of the following events occur:
 - i. The project has experienced a change that affects the critical path.
 - ii. The sequence of Work is changed from that in the approved schedule.
 - iii. The project is significantly delayed.
 - iv. Upon receiving an extension of Contract time.

The Contractor shall submit one electronic copy of the Schedule Update within 15 calendar days of receiving a written request, or when an update is required by any other portion of the Contract. A "significant" delay in time is defined as 10 working days or 10 percent of the original Contract time, whichever is greater.

In addition to the other requirements in this Section, Schedule Updates shall reflect the following information:

- i. The actual duration and sequence of as-constructed Work activities, including changed Work.
- ii. Approved time extensions.
- iii. Any construction delays or other conditions that affect the progress of the Work.
- iv. Any modifications to the as-planned sequence or duration of remaining activities.
- v. The Substantial and Physical Completion of all remaining Work in the remaining Contract time.

Unresolved request for time extensions shall be reflected in the Schedule Update by assuming no time extension will be granted, and by showing the effects to follow-on activities necessary to substantially and physically complete the project within the currently authorized time for completion.

- e. The original Progress Schedule and all Schedule Updates shall not conflict with any time and order-of-work requirement in the Contract.
- f. If the Engineer deems that the original or any necessary supplemental progress schedule does not provide the information required in this section, the Owner may withhold progress payments until a schedule containing the required information has been submitted by the Contractor and accepted by the Engineer.
- g. The Contractor shall comply with other progress schedule requirements that are further defined in the Specifications.
- h. The Engineer's approval of any schedule shall not transfer any of the Contractor's responsibilities to the Owner. The Contractor alone shall remain responsible for adjusting forces, equipment, and work schedules to ensure completion of the work within the time(s) specified in the Contract.

3.04.15(2) Extensions of the Contract Time

- a. The Contractor specifically waives claims for damages for any hindrance or delay, excepting unreasonable delays caused by the Owner. In lieu thereof, the Contractor will be granted equitable extensions of the Contract Time for which liquidated damages will not otherwise be claimed by the Owner under the following circumstances:

- i. A delay caused by any suit or other legal action against the Owner will entitle the Contractor to an equivalent extension of time, unless the period of such delay exceeds 90 calendar days. When such period is exceeded, the Owner will, upon written request of the Contractor, either negotiate a termination of the Contract or grant a further extension of the Contract Time, whichever is in the best interests of the Owner.
- ii. Should any other unforeseen condition occur that is beyond the reasonable control of Contractor, requires more time for the Contractor to complete the performance of the Work by the Substantial Completion Date, the Contractor shall notify the Owner and the Engineer in writing prior to the performance of such Work, and in any event within 10 calendar days after the occurrence of the unforeseen condition. The notice shall set forth in detail the Contractor's estimate of the required time extension. The Owner will allow such equitable extension of the Contract Time that the Engineer determines to be appropriate. Failure to comply with the notice provisions required by the Contract shall be deemed a complete waiver of any entitlement to adjustment of the Contract Time.

3.04.15(3) Liquidated Damages

- a. The Contractor acknowledges that the Owner will suffer monetary damages in the event of an unexcused delay in the Substantial Completion Date and the Physical Completion Date of the Work. If the Contractor fails, without excuse under the Contract, to complete the Work within the Contract Time, or any proper extension thereof granted by the Owner, the Contractor agrees to pay to the Owner the amount specified in the Proposal form, not as a penalty, but as liquidated damages for such breach of the Contract, for each day that the Contractor shall be in default after the time stipulated for the Substantial Completion Date and the Physical Completion Date of the Work.
- b. The amount of liquidated damages is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is specifically agreed to be a reasonable approximation of damages that the Owner would sustain as a result of an unexcused delay in the Substantial Completion Date and the Physical Completion Date; said amount may be retained from time to time by the Owner from current progress payments.

3.04.16 COMPLETION AND ACCEPTANCE OF THE WORK

3.04.16(1) Substantial Completion Date

- a. When the Contractor considers the Work to be substantially complete and ready for its intended purpose, the Contractor shall notify the Engineer in writing and include an itemized list of remaining Work to be completed. On the Substantial Completion Date, the Owner shall have full and unrestricted use and benefit of all of the

facilities that comprise the Work, both from an operational and safety standpoint, with only minor incidental work, replacement of temporary substitute facilities, or correction or repair of work remaining for the physical completion of the total Work.

- b. If the Engineer determines that the Work is not substantially complete, it will so notify the Contractor in writing identifying those items of the Work that shall be completed by the Contractor in order to achieve the Substantial Completion Date.
- c. If the Engineer believes that the Work is substantially complete, the Engineer will meet with the Contractor to: (1) prepare a list of incomplete or unsatisfactory items of the Work that shall be completed or corrected; (2) define the division of responsibility between Owner and Contractor with respect to security, operation, maintenance, heat, utilities, insurance, etc., for the facilities; and (3) describe any other issues related to approval of the substantially completed Work. Upon reaching agreement with the Contractor, the Engineer will notify the Owner that, in its opinion and based on the information supplied by the Contractor, the Work is substantially complete, listing the items of incomplete Work, defining the division of responsibilities for the facilities, and setting forth any other terms related to final completion and acceptance.
- d. The Owner, who has sole authority to make the determination of the Substantial Completion Date, will review the Engineer's recommendation that the Work is substantially complete and, if it concurs, will instruct the Engineer to notify the Contractor that the Work is accepted as being substantially complete. Except for any portion(s) of Work specified for early completion or required by the Owner for early possession, substantial completion will not occur for any portion of the Work until the entire Work is ready for possession and use. The approval notice will include a list of incomplete Work items, establish the Substantial Completion Date, and describe any other terms relating to such approval. The Contractor shall acknowledge receipt of the approval notice in writing, indicating acceptance of all of its terms and provisions.
- e. The date of Substantial Completion, as determined by the Engineer and agreed to by the Owner, shall be the date for the beginning of the warranty period.
- f. Subsequent to the Substantial Completion date, the Owner may exclude the Contractor from the Work during such periods when construction activities might interfere with the operation of the Project. The Owner, however, shall allow the Contractor reasonable access for completion of incomplete punch list items.

3.04.16(2) Physical Completion Date

- a. The Contractor shall complete all physical Work within the Contract Time.
- b. Upon physical completion of the Work, including completion of all corrective Work described in Section 3.04.16(1) above and the submission of all required

record drawings, operation and maintenance manuals, manufacturers' affidavits, software and programming, and other items required by the Contract, the Contractor shall notify the Engineer in writing that the Work is physically complete. Upon receipt of the notification, the Engineer will determine if the Work is physically complete in accordance with the Contract. If the Engineer determines that any materials, equipment, or workmanship do not meet the requirements of the Contract, the Engineer will prepare a list of such items and submit it to the Contractor. Following the satisfactory completion of the corrective Work by the Contractor, the Engineer will notify the Owner that the Work is physically complete in accordance with the requirements of the Contract.

- c. The Engineer, with the concurrence of the Owner, will give the Contractor written notice of the Physical Completion Date for all of the Work. The Physical Completion Date shall not constitute the Owner's acceptance of the Work.

3.04.16(3) Contract Completion Date (Acceptance of the Project)

- a. When all of the Contractor's obligations under the Contract have been performed satisfactorily, the Owner will provide the Contractor with written notice of the Contract Completion Date. The following events shall occur in order for the Contractor to achieve the Contract Completion Date:
 1. The Contractor shall have achieved the Substantial Completion Date and the Physical Completion Date for the Work; and
 2. The Contractor shall furnish all documentation required by the Contract and required by law. The documents shall include, but are not limited to, the following:
 - i. Complete and legally effective releases and/or waivers of liens or bond or retainage claims in a form acceptable to the Owner. Subject to prior approval of the Owner, the Contractor may, if approved by the Owner, submit in lieu of the lien or claims releases and waivers: (1) receipts showing payment of all accounts in full; (2) an affidavit that the release and receipts cover all labor, services, materials, and equipment for which a lien or other claim could be filed and that all payrolls, material, and equipment bills and other indebtedness connected with the Work for which the Owner or the Owner's property might in any way be responsible, have been paid; and (3) the consent of the surety, if any, to final payment. If any Subcontractor or supplier fails to furnish a release waiver or receipt in a form satisfactory to the Owner, the Contractor may be permitted by the Owner to furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any lien or similar claim;
 - ii. Certified Payrolls (Federal Aid projects or if requested);

- iii. Final Contract Voucher Certification.
 - iv. Affidavits of Wages Paid for the Contractor and all subcontractors must be submitted to the Owner.
- b. The Contractor agrees that neither completion nor final acceptance shall relieve the Contractor of the responsibility to indemnify, defend, and protect the Owner against any claim or loss resulting from the failure of the Contractor (or the subcontractors or lower tier subcontractors) to pay all laborers, mechanics, subcontractors, material persons, or any other person who provides labor, supplies, or provisions for carrying out the work or for any payments required for unemployment compensation under Title 50 RCW or for industrial insurance and medical aid required under Title 51 RCW.

Final acceptance shall not constitute acceptance of any unauthorized or defective work or material. The Owner shall not be barred from requiring the Contractor to remove, replace, repair, or dispose of any unauthorized or defective work or material or from recovering damages for any such work or material.

3.04.16(4) Use of Completed Portions of the Work

The Owner reserves the right to use and occupy any portion of the Work which has been completed sufficiently to permit partial use and occupancy, and such partial use and occupancy shall not be construed as an acceptance of the Work as a whole or any part thereof. Any claims that the Owner may have against the Contractor shall not be deemed to have been waived by such partial use and occupancy.

3.04.16(5) Waiver of Claims by Contractor

The Contractor's acceptance of the final payment from the Owner constitutes an irrevocable and complete waiver of any and all claims against the Owner under the Contract or otherwise arising from the Work, except for those claims that have been properly identified in writing in advance of final payment, and for which timely and sufficient prior written notice has been given, all in accordance with the Contract.

3.04.17 CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT

The Owner's final payment to the Contractor shall not relieve the Contractor of responsibility for faulty materials, equipment or workmanship. The Contractor shall promptly repair or replace any such defects discovered within the warranty or other applicable limitations period.

3.04.18 RETAINAGE

1. Pursuant to RCW 60.28, there will be retained from monies earned by the Contractor on progress estimates a sum not to exceed 5 percent of the monies earned by the Contractor. Such retainage shall be used as a trust fund for the protection and payment (1) to the State with respect to taxes imposed pursuant to

RCW Title 82, which may be due from such Contractor, and (2) the claims of any other person or entity arising under the Contract or RCW 60.28.

2. Monies retained pursuant to RCW 60.28 shall, at the option of the Contractor, be:
 - a. Retained in a fund by the Owner;
 - b. Deposited by the Owner in an interest-bearing account in a bank, mutual savings bank, or savings and loan association (interest on monies so retained may be paid to the Contractor);
 - c. Deposited by the Owner in an escrow (interest-bearing) account in a bank, mutual saving bank, or savings and loan association (interest on monies so retained shall be paid to the Contractor). Deposits are to be in the name of the Owner and are not to be allowed to be withdrawn without the Owner's written authorization. The Owner will issue a check representing the sum of the monies reserved, payable to the bank or trust company;
 - d. In choosing option (b) or (c), the Contractor agrees to assume full responsibility to pay all costs which may accrue from escrow services, brokerage charges or both, and further agrees to assume all risks in connection with the investment of the retainage in securities.

At the time the Contract is executed the Contractor shall designate the option desired.

3. Release of retainage will be made within the statutory period following the last date for filing of claims pursuant to RCW Chapter 60.28, provided that the following conditions are met:
 - a. A release has been obtained from the Washington State Department of Revenue;
 - b. A "Certificate of Payment of Contributions Penalties and Interest on Public Works Contract" is received from the Washington State Employment Security Department;
 - c. The Washington State Department of Labor and Industries indicates the Contractor is current on the payment of industrial insurance and medical aid premiums;
 - d. All claims by the Owner against the Contractor have been resolved;
 - e. No claims have been filed against the retained percentage;
 - f. All required "Affidavits of Wages Paid" are on file with the Owner for the Contractor and all Subcontractors, regardless of tier;

4. In the event that claims are filed against the retainage, the Contractor will be paid the retained percentage less an amount sufficient to pay all such claims, together with a sum determined by the Owner to be sufficient to pay the costs of foreclosing on claims and to attorneys' fees, all in accordance with applicable law.

3.05 DISPUTES AND CLAIMS

3.05.1 DISPUTES

When disputes occur, the Contractor shall pursue resolution through the Engineer. The Contractor shall follow the notice and protest procedures outlined in Section 3.04. If negotiation using the procedures outlined in Section 3.04 fails to provide satisfactory resolution, the Contractor shall pursue the more formalized method set forth in Section 3.05.2 for submitting claims.

3.05.2 CLAIMS

If the Contractor contends that additional payment is due, has provided timely notices and protests as required by Section 3.04, and the Contractor has pursued and exhausted all of the means provided in that section to resolve the dispute, the Contractor may submit a claim as provided in this Section. Any claim for an increase in the Contract Price or for an extension of the Contract Time by the Contractor is waived if the written notifications and protests required in Section 3-04 have been not provided, or if the Engineer is not afforded reasonable access to the Contractor's complete records relating to the claim, as required by Section 3-04.8, or if a claim is not submitted in accordance with the requirements of this Section. The fact that the Contractor has provided proper notification, properly submitted a claim, or provided the Engineer with access to records, shall not in any way be construed as proving or substantiating the validity of the claim. If, after consideration by the Owner, the claim is found to have merit, the Owner will make an equitable adjustment to either the Contract Price, the Contract Time, or both. If the Owner finds the claim to be without merit, no adjustment will be made.

All claims submitted by the Contractor shall be in writing and in sufficient detail to enable the Engineer to ascertain the basis for and amount of the claim. All claims shall be submitted to the Engineer in the manner in Section 3.03.6. The following information shall accompany each claim submitted:

1. A detailed factual statement of the basis for the claim for additional compensation and/or extension of time, including all relevant dates, locations, and items of work relating to the claim.
2. The date on which the events occurred that give rise to the claim.
3. The name of each person involved in or having knowledge about the claim.
4. The specific provisions of the Contract which support the claim and a statement of the reasons why such provisions support the claim.

5. If the claim relates to a decision of the Engineer that the Contract leaves to the Engineer's discretion or as to which the Contract provides that the Engineer's decision is final, the Contractor shall set out in detail all facts supporting its position relating to the decision of the Engineer.
6. The identification of any documents and the substance of any oral communications that support the claim.
7. Copies of any identified documents, other than Owner documents and documents previously furnished to the Owner by the Contractor, that support the claim (manuals which are standard to the industry may be included by reference).
8. If an extension of the Contract Time is sought:
 - a. The specific days and dates for which the extension is sought;
 - b. The specific reasons why the Contractor believes a time extension should be granted;
 - c. The specific provisions of Section 3-04.15(2) under which the time extension is sought; and
 - d. An analysis of the Contractor's progress schedule, demonstrating the reasons why a time extension should be granted.
9. If additional compensation is sought, the exact amount sought and a breakdown of that amount into the following categories:
 - a. Labor;
 - b. Materials;
 - c. Direct equipment. The actual cost for each piece of equipment for which a claim is made, or, in the absence of actual cost, the rates established by the AGC/WSDOT Equipment Rental Agreement which was in effect when the Work was performed. The amounts claimed for any piece of equipment shall not exceed the rates established by the Equipment Rental Agreement, even if the actual cost for such equipment is higher. The Owner may audit the Contractor's cost records, as provided in Section 3.06, to determine actual equipment costs. The following information shall be provided for each piece of equipment:
 - i. Detailed description (e.g., make, model, year, diesel or gas, size of bucket);
 - ii. The hours of use or standby; and
 - iii. The specific day and dates of use or standby.
 - d. Subcontractor claims (in the same level of detail as specified herein); and

e. Other information as requested by the Engineer or the Owner.

10. A notarized statement containing the following language:

Under the penalty of law for perjury or falsification, the undersigned,

_____, _____
(name) (title)

of _____
(company)

hereby certifies that the claim for extra compensation and time, if any, made herein for work on this Contract is a true statement of the actual costs incurred and time sought, and is fully documented and supported under the contract between the parties.

Dated _____/s/_____

Subscribed and sworn before me this _____ day of _____

Notary Public

My Commission Expires:_____

It will be the responsibility of the Contractor to keep full and complete records of the costs and additional time incurred with respect to any claim. The Contractor shall permit the Engineer to have access to those records and any other records and documents as may be required by the Engineer to determine the facts or contentions involved in the claim. The Contractor shall retain all records and documents in any way relating to the Work for a period of not less than three years after the Contract Completion Date.

The Contractor shall in good faith attempt to reach a negotiated resolution of all claims with the Engineer or its designee.

The Contractor's failure to submit with the Final Contract Voucher Certification a list of all claims, together with the information and details required by this Section shall operate as a waiver of the claims by the Contractor, as provided in Section 3.04.12(9).

If the Contractor submits a claim in full compliance with all the requirements of this Section, the Owner will respond in writing to the claim as follows:

1. Within 45 calendar days from the date the claim is received by the Owner, if the claim amount is less than \$100,000;

2. Within 90 calendar days from the date the claim is received by the Owner, if the claim amount is equal to or greater than \$100,000; or
3. If these time periods are unreasonable due to the complexity of the claim, the Contractor will be notified within 15 calendar days from the date the claim is received by the Owner of the amount of time which will be necessary for the Owner to evaluate the claim and issue a response.

Full compliance by the Contractor with the provisions of this Section is a condition precedent to the Contractor's right to seek commence a lawsuit or pursue other legal remedies.

3.05.3 TIMELINE AND JURISDICTION

For the convenience of the parties to the Contract it is mutually agreed by the parties that any claims or causes of action which the Contractor has against the Owner arising from the Contract shall be brought within 180 calendar days from the date of Physical Completion (Section 3.04.16(2)) of the Contract by the Owner; and it is further agreed that any such claims or causes of action shall be brought only in the Superior Court of the county where the Owner headquarters is located, provided that where an action is asserted against a county, RCW 36.01.05 shall control venue and jurisdiction. The parties understand and agree that the Contractor's failure to bring suit within the time period provided, shall be a complete bar to any such claims or causes of action. It is further mutually agreed by the parties that when any claims or causes of action which the Contractor asserts against the Owner arising from the Contract are filed with the Owner or initiated in court, the Contractor shall permit the Owner to have timely access to any records deemed necessary by the Owner to assist in evaluating the claims or action.

3.05.4 CONTINUATION OF WORK PENDING RESOLUTION OF DISPUTES

The Contractor shall expeditiously carry on the Work, adhere to the progress schedule, and comply with all written directives of the Owner or the Engineer regardless of any dispute or claim that may exist between the Owner and the Contractor. No Work shall be delayed or postponed pending resolution of any dispute or claim. Failure or refusal of the Contractor to comply with the written directives of the Owner or the Engineer shall constitute a material breach of the Contract and immediately constitute grounds for the Owner to withhold payments to the Contractor, suspend the Work or terminate the Contract. Notice under this Section shall be in accordance with other provisions of the Contract.

3.06 NOT USED

3.07 SUSPENSION OF WORK AND TERMINATION OF CONTRACT

3.07.1 SUSPENSION OF WORK

1. The Owner or the Engineer may order suspension of all or any part of the Work if:
 - a. Unsuitable or other conditions that are beyond the reasonable control of the Contractor exist or arise that prevent satisfactory and timely performance of the Work; or
 - b. The Contractor does not comply with the Contract; or
 - c. It is in the public interest.
2. If the Engineer determines that the suspension is for reasons set forth in Subsection a. or c. above, an equitable adjustment will be made in the Contract Time but not the Contract price. If the Engineer determines that the suspension is for reasons set forth in Subsection b. above, no adjustment shall be made in the Contract Time or the Contract Price.
3. If the Contract is suspended for reasons set forth in Subsection a. or c. above and the Contractor believes that the suspension of performance of all or part of the Work has continued for an unreasonable period of time, the Contractor shall give written notice to the Engineer of its intention to seek an equitable adjustment in the Contract Time or the Contract price. In the event that an equitable adjustment is allowed, no adjustment shall be allowed for any time lost or costs incurred more than 10 calendar days before delivery of the written notice to the Engineer. No profit of any kind will be allowed on any increase in costs due to the suspension, delay or interruption.

3.07.2 TERMINATION FOR DEFAULT

1. The Owner may terminate the Contract for default, effective seven days following delivery of written notice of default to the Contractor, if the Contractor:
 - a. Refuses or fails to supply enough properly skilled laborers or conforming materials to complete the Work in a timely manner;
 - b. Refuses or fails to prosecute the Work with such diligence as will ensure its physical completion by the Physical Completion Date;
 - c. Performs work which deviates from the requirements of the Contract and refuses or fails to correct the non-conforming work;
 - d. Fails to make prompt payment to Subcontractors and/or suppliers for labor or materials;

- e. Fails to comply with laws, ordinances, rules, regulations or orders of a public authority having jurisdiction; or
 - f. Otherwise fails to follow written directives of the Owner or the Engineer or is in default of a material provision of the Contract.
2. If the Contractor abandons the Work for any cause other than failure of the Owner to make monthly progress payments for Work properly performed, or if the Contractor refuses to comply with requirements of the Contract, the Owner has the additional right to notify the Contractor's performance bond surety and require the surety to complete the Work in accordance with the Contract.

3.07.3 TERMINATION FOR CONVENIENCE OF THE OWNER

The Owner may by written notice terminate the Contract at any time in whole or in part, without cause, and except where termination is due to the Contractor's default, the Owner shall pay the Contractor that portion of the Contract price corresponding to the acceptable Work completed to the Owner's satisfaction, together with reasonable costs, as determined in the sole discretion of the Owner, necessarily incurred by the Contractor in terminating the remaining portion of Work, less any payments made before termination. In no event shall the Owner be required to pay the Contractor any amount in excess of the completed portion Contract price. The Owner shall not be required to pay the Contractor any amount for consequential damages including but not by means of limitation lost or anticipated profits on Work that is not performed as a result of termination.

3.07.4 RESPONSIBILITY OF THE CONTRACTOR AND SURETY

Termination of the Contract shall not relieve the Contractor of any responsibilities under the Contract for Work performed. Nor shall termination of the Contract relieve the sureties of their obligations under the bonds required or permitted by the Contract or applicable law.

PART 5

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

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DIVISION 1

GENERAL TECHNICAL REQUIREMENTS

SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.1 SCOPE OF WORK

The work specified in this Section consists of furnishing all labor, materials, and equipment necessary for construction of the water system improvements, as shown on the Plans, and hereinafter specified, at the existing Shadowood reservoir, pump station, and well site. Work shall include, but not be limited to, the following:

- A. Construct new concrete reservoir.
- B. Construct new booster pump/treatment building.
- C. Furnish and install HVAC system.
- D. Furnish and install iron and manganese filtration system.
- E. Furnish and install backwash recycle system.
- F. Furnish and install booster pump system.
- G. Furnish and install all required piping and appurtenances inside the booster pump and treatment building.
- H. Furnish and install new raw water, finished water, and storm sewer site piping.
- I. Replace existing well pump.
- J. Modify existing well pump building.
- K. Relocate and connect existing chemical feed system.
- L. Furnish and install all required electrical, instrumentation, and telemetry.
- M. Furnish and install onsite generator and automatic transfer switch.
- N. Provide testing, commissioning, and training as specified herein.

- O. Demolish existing reservoir and pump station.
- P. Regrade, clean, and restore site.
- Q. Provide all associated work as shown on the Plans and specified herein, for a complete and workable system.

1.2 PROJECT INFORMATION

The Contract Documents show the location, arrangement, and type of work to be performed under the proposed project.

The Contractor shall be responsible for proper notification to and coordination with all utility districts, service districts, and all other persons and services that will be affected by this project at least one week in advance of beginning any construction that affects them.

It is the intent and purpose of these Contract Documents to have constructed complete facilities in good working order for the least practical cost to the Owner. Suggestions, recommendations, as well as inquiries from the Contractor that will serve this purpose are welcome and will be given consideration by the Owner and the Engineer.

1.3 CONTRACTOR USE OF SITE AND PREMISES

Construction operations shall be limited to the areas noted on the Plans and subject to the approval of the Engineer.

The Contractor shall allow representatives of the Owner, funding, and regulatory agencies access to the project site at all times.

The existing well, pump station, and reservoir must remain in operation through the construction, testing, and commissioning of this project. Refer to Section 01510 for the number and duration of outages for each system component. The Contractor shall notify the Owner at least 48 hours in advance of any proposed water system shut downs. The Contractor shall also be responsible for notifying all impacted water users 48 hours in advance of any water shutoff.

1.4 ORDER OF WORK

The order of work will be at the option of the Contractor, except as noted below, in keeping with good construction practice, time restrictions, requirements of the permits applicable to this project, and the order of work as outlined herein, all costs of which shall be included in the various bid amounts. The Contractor shall conduct the order of work to allow the existing facilities to remain operational

during the construction of the Project and shall coordinate all of their activities through the Engineer with the Owner's operations and maintenance staff. The Contractor shall provide a written plan of activities to the Engineer and Owner each Thursday for the following week, for review and coordination with existing facility operations.

The implementation of any measure required to protect the environment shall supersede any order of work designated within these Specifications. The Contractor shall meet the conditions as outlined in any and all permits and requirements of the Federal, State, County, and City regulatory agencies.

The Contractor shall keep the disruption of the existing facility operations to a minimum. Refer to section 01510 for presumable shut-downs of existing system components.

Access to the existing operations areas shall be maintained. Disruption of this access shall be kept to a minimum and must be prearranged and scheduled through the Engineer with the Owner's operations and maintenance staff.

The following summary shall be used as a general guideline of the construction tasks to be performed. The tasks are generally listed in the order of completion. The tasks, however, can be completed in a different order than listed herein, including performance of two or more tasks concurrently. The Contractor shall prepare a complete project schedule, which shall be provided in accordance with the limitations specified herein.

A. BOOSTER PUMP/TREATMENT BUILDING AND RESERVOIR CONSTRUCTION

All work associated with the construction new booster pump/treatment building and the reservoir and the furnishing of equipment and appurtenances must be complete before the existing facility can be taken offline

B. SITE PIPING

All storm, raw water, and finished water piping must be installed, connecting the existing well building, proposed booster pump/treatment building, and proposed reservoir.

C. TESTING, COMMISSIONING, AND TRAINING

Testing commissioning and training may only occur after the building has been largely complete and equipment has been furnished and installed.

This must take place before the demolition and decommissioning of any existing facilities.

D. DEMOLITION OF EXISTING FACILITIES

The existing booster pump building and reservoir may only be demolished after testing, commissioning, and training are complete and the new water system improvements can safely deliver water to the distribution system.

E. REGRADING AND RESPORTATION

The site will be regraded and restored as shown on the plans after the existing facilities have been demolished and all other work is complete

***** END OF SECTION *****

SECTION 01150

SURVEYS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes all survey for the project. The Contractor shall provide all construction survey for the Work. The Engineer will provide primary horizontal and vertical control data and monuments, as shown on the Plans.

At the Contractor's request, the Engineer will provide the Plans in electronic format. Electronic files are provided for the Contractor's convenience and are not part of the Contract. Calculations shall be made from the Plans.

During the prosecution of the work, the Contractor shall make all necessary measurements to prevent misfitting, and shall be responsible for the accurate construction of the work.

1.2 DEFINITIONS

The meaning of words and terms used in this provision shall be as listed in "Definitions of Surveying and Associated Terms" current edition, published by the American Congress on Surveying and Mapping, and the American Society of Civil Engineers.

1.3 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01720	Record Drawings

1.4 QUALIFICATIONS

The Contractor shall employ a Professional Land Surveyor (PLS) registered in the State of Washington and acceptable to the Owner. All surveying shall be completed by or under the direct supervision of the PLS.

1.5 SUBMITTALS

The Contractor shall submit the name, address, and license number of the Professional Land Surveyor before starting construction.

1.6 QUALITY ASSURANCE

The Contractor shall ensure a surveying accuracy within the following tolerances:

	<u>Vertical</u>	<u>Horizontal</u>
Slope Stakes	±0.1 feet	±0.10 feet
Subgrade Grade Stakes Set 0.04 foot Below Grade	±0.01 feet	±0.5 feet (parallel to alignment) ±0.1 feet (normal to alignment)
Stationing on Roadway	N/A	±0.1 feet
Alignment on Roadway	N/A	±0.04 feet
Surfacing Grade Stakes	±0.01 feet	±0.1 foot (parallel to alignment) ±0.1 feet (normal to alignment)
Roadway Paving Pins for Surfacing or Paving	±0.01 feet	±0.1 feet (parallel to alignment) ±0.05 feet (normal to alignment)
Alignment of sewer and storm manholes and catch basins	±.01 feet	±0.1 feet
Stationing on Structures		±.02 feet
Alignment on structures		±.02 feet
Superstructure elevations	±.01 feet variation from Plan elevation	
Substructure	±.02 feet variation from Plan grades	

When the following items are included in the project, the Contractor shall perform independent checks from different secondary control to ensure that the points staked are within the specified survey accuracy tolerances:

- Piles
- Shafts
- Footings
- Columns

The Owner may spot-check the Contractor's surveying. These spot-checks will not change the requirements for accuracy by the Contractor

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

The Contractor's PLS shall establish all secondary survey controls, horizontal and vertical, as necessary to assure proper placement of all Work based upon the primary control points provided by the Owner. The Contractor shall be responsible for setting, maintaining, and resetting all alignment stakes, clearing limit stakes, slope stakes, and grades for the Work. Except for the survey control data to be furnished by the Owner, calculations, surveying, and measuring required for setting and maintaining the lines and grades shall be the Contractor's responsibility.

Survey records shall be maintained by the Contractor's PLS, including a description of the work performed on each shift, the methods utilized, and the control points used. The record shall be adequate to allow the survey to be reproduced. A copy of each day's record shall be provided to the Engineer within three working days of Engineer's request.

All surveyed points shall be established by placing hubs and tacks with marked stakes in unpaved areas or P.K. nails with painted markings in paved areas. All surveying stakes shall be marked in accordance with WSDOT Standard Plan A-10.10-00. When stakes are needed that are not described in the Standard Plans, then those stakes shall be marked as ordered by the Engineer. The Contractor's surveyor shall maintain and replace survey hubs, stakes, nails and markings immediately if destroyed, removed, or the Engineer determines the stake or pavement markings are illegible.

The Engineer is responsible for locating and referencing those monuments shown on the Plans, of being removed or destroyed during construction, and preparing the required permit forms with the Department of Natural Resources (DNR) for

those monuments only. The Contractor shall protect all survey markers, monuments and property corners unless shown otherwise on the Plans. The Contractor shall work to preserve the existing monumentation as provided in RCW 58.09.130 and WAC 332-120. The Contractor shall notify the Engineer immediately if it becomes apparent that a survey marker will be disturbed due to construction. The Contractor shall allow 5 working days for the Engineer to acquire adequate information so that the monument, including property corners, may be replaced referenced in its original position prior to disturbance. All cost associated with replacement of monuments that have been disturbed before being referenced due to lack of proper notification by the Contractor shall be deducted from monies due to the Contractor.

***** END OF SECTION *****

SECTION 01160

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section contains information pertaining to permits and licenses, and use of private property.

1.2 PERMITS AND LICENSES

Except as noted below, the Contractor shall be responsible for obtaining and paying all fees associated with all the necessary permits, licenses, approvals, and construction permits necessary for the execution of this Contract, whether they be City, County, State, or federal permits.

The Owner is in possession of, or will be responsible for obtaining the following approvals and permits, and will pay the fees associated with the application and procurement of such approvals and permits. The Contractor is advised to become familiar with these approvals and permits as necessary for this project. The Contractor shall comply with all conditions of each approval/permit as if the conditions were detailed herein. Copies of these permits are required to be onsite at all times.

- A. Washington Department of Health Approval (obtained by Owner)
- B. Washington Department of Health Drinking Water State Revolving Fund Loan (Obtained by owner)
- C. Mason County Building Permit (applied and paid for by Owner, obtained by Contractor)
- D. Mason County Demolition Permit (applied and paid for by Owner, obtained by Contractor)

1.3 USE OF PRIVATE PROPERTY

The Contractor shall be responsible for all conditions of any arrangements the Contractor makes for the use of any privately owned property.

In the event any dispute occurs and claims for damages are filed by the property owners, the Owner will request that the Contractor give evidence that they have requested their insurance company to make personal contact with the claimants.

Any settlement for insurance claims shall be strictly an act restricted to the claimant, the Contractor, and their insurance company.

The Contractor is advised that in the event of any property damage, the Owner reserves the right to withhold monies to protect the property owner.

1.4 PROPERTY RELEASE FORM

The Contractor shall be held responsible for acquiring signed property release forms, in the format provided on the following page, for all properties that have been disturbed or damaged by the Contractor's operations, or utilized by the Contractor for staging, storing, or stock piling of materials or equipment.

This work shall include submitting the form(s), as further shown herein, by certified mail to each property owner effected and further including therein a self addressed stamped envelope for the property owner's use. The enclosed self addressed envelope shall be addressed to: Mason County PUD No. 1, 21971 North Highway 101, Shelton, Washington 98584. Contractor shall provide evidence of all certified mailings.

***** END OF SECTION *****

PROPERTY RELEASE

(Property Address)

DATE: _____

I, _____, owner of _____
(Property Owner's Name) (Property Description or
_____, hereby release
Address)

_____, from any property
(Contractor's Name)

damage or personal injury resulting from construction adjacent
to or on my property located at _____,
(Property Address)
during construction of the Shadowood Water System Improvements.

My signature below is my acknowledgment and acceptance that my property, as
identified above, was returned to a satisfactory condition.

Name: _____

Signed: _____

Address: _____

Phone: _____

SECTION 01200

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SCOPE

This Section further defines Measurement and Payment for this project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
GC Section 3.04.12	Measurement and Payment
01290	Schedule of Values
01300	Submittals

1.3 MEASUREMENT

Measurement for all items shall be as indicated in these Specifications for unit price and lump sum price bid items. Bid items are outlined in detail in this Specification Section and listed in the Proposal.

Measurement shall be in accordance with Section 1-09.1 of the WSDOT Standard Specifications. Volumes of gravel materials and concrete volumes shall be measured by the Engineer in the field and quantities will be limited to the relative neat line dimensions shown on the Plans or as approved by the Engineer in the field.

Weighing equipment, scale verification checks, load tickets for quarry spalls, rock riprap, cobbles, gravel materials, hot mix asphalt, bituminous construction materials, etc., shall conform to Section 1-09.2 of the WSDOT Standard Specifications. Load tickets shall include all gravel materials, cast-in-place concrete, cement grout, CDF, hot mix asphalt, ATB, and reinforcing steel. The Owner will pay for no material received by weight unless they have been weighed as required in this Section or as required by another method the Engineer has approved in writing. All costs incidental to weighing shall be merged into the various unit prices bid.

1.4 INDIVIDUAL BID ITEMS

The following is a list of bid items for the project. The contract price for each item constitutes full compensation for furnishing all equipment, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the various bid items in accordance with the Contract

Documents. Payment for each item shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. Work paid for under one item will not be paid for under any other item. If a particular item of work shown on the Plans or described in Specifications is not described in a specific bid item, this item of work shall be considered as incidental to the work and the costs for this work shall be merged into the various respective unit price and lump sum bid items.

A. BASE BID

1. Mobilization and Demobilization

- a. Measurement: Will be measured by lump sum.
- b. Payment: The lump sum contract price for MOBILIZATION AND DEMOBILIZATION shall include all costs for the labor, materials, and equipment required for mobilization and demobilization on the project as described in Section 01505.

Payment for MOBILIZATION AND DEMOBILIZATION shall be as follows:

35% Payment: When Contractor has mobilized on-site and temporary facilities are in place.

50% Payment: When 5 percent of the total pay items are completed (not including payment for materials on hand).

75% Payment: When 50 percent of the total pay items are completed (not including payment for materials on hand).

100% Payment: When Project is completed and recommended for acceptance.

2. Minor Change

- a. Measurement: Will be negotiated prior to commencing any such work under this pay item and shall be for work to remedy unforeseen conditions, utility conflicts, minor landscaping, minor drainage improvements, or special surface restoration.

- b. Payment: Payment or credits for changes amounting to \$25,000 or less may be made under the Bid Item MINOR CHANGE. At the discretion of the Owner, this procedure for Minor Changes may be used in lieu of the more formal procedure as outlined in General Conditions Section 3.04.6. The Contractor will be provided a copy of the completed order for Minor Changes. The agreement for the Minor Changes will be documented by signature of the Contractor or notation of the verbal agreement. If the Contractor is in disagreement with anything required by the order for Minor Changes, the Contractor may protest the order as provided in General Conditions Section 3.04.8.

Payments or credits will be determined in accordance with General Conditions Section 3.04.6. All Minor Change work will be within the scope of the Contract Work and will not change Contract Time. For the purpose of providing a common Proposal for all Bidders, the Owner has entered an amount for MINOR CHANGE in the Proposal to become part of the total Bid by the Contractor.

3. Temporary Erosion and Sediment Control

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for EROSION CONTROL shall include all costs for the labor, material, and equipment for installation and maintenance of all temporary erosion and sediment control measures and best management practices (BMPs), including the installation and removal of the construction entrance, as shown on the Plans and as further described in Section 02370.

4. Trench Excavation Safety Systems

- a. Measurement: Will be measured by lump sum.
- b. Payment: The lump sum contract price for TRENCH EXCAVATION SAFETY SYSTEMS shall include all costs for labor, materials, and equipment required to provide sheeting, shoring, and bracing of trenches and open excavations as required to meet the Washington Industrial Safety and Health Act, Chapter 49.17 RCW and Section 02250. These costs shall not be considered incidental to any other bid item.

5. Locate Existing Utilities
 - a. Measurement: Will be measured by lump sum.
 - b. Payment: The lump sum contract price for LOCATE EXISTING UTILITIES shall include all costs for labor, materials, and equipment required to pothole and locate existing utilities as shown on the Plans and as specified in Section 02050.

6. Unsuitable Excavation
 - a. Measurement: Will be measured by the cubic yard, in-place and shall be to the limits as designated by the Engineer. There shall be no payment if the Engineer believes removal of materials is needed because of damage caused by the Contractor's operations.

All quantities will be measured and recorded by the Engineer in their Daily Report and the Contractor shall be responsible for reconciling their quantities with the Engineer on a daily basis.
 - b. Payment: The unit price per cubic yard for UNSUITABLE EXCAVATION shall include all cost for labor, material, and equipment to excavate and wastehaul unsuitable native subgrade materials.

The Contractor is advised that the excavation of any and all unsuitable material must be authorized by the Engineer in writing prior to the commencement of said excavation by the Contractor.

7. Bank Run Gravel for Backfill
 - a. Measurement: Shall be measured per ton, in-place, based on truck tickets and shall be to the limits designated and approved by the Engineer.
 - b. Payment: The unit price bid per ton for BANK RUN GRAVEL FOR BACKFILL shall include all costs for the labor, material, and equipment associated with furnishing, installing, compacting and testing, and wastehaul of native material as shown on the Plans and as specified herein.

Payment shall be based upon the weight of material installed.

8. Crushed Surfacing Base Course

- a. Measurement: Shall be measured per ton and shall be to the limits shown on the Plans or as required by encountered subgrade conditions as approved by the Engineer.
- b. Payment: The unit price bid per ton for CRUSHED SURFACING BASE COURSE shall include all costs for the labor, material, and equipment for furnishing and installing foundation gravel in trenches and below structures as shown on the Plans and as described Section 02700. The quantity of material for payment shall be based upon volume of material placed within the neat line limits as shown on the Plans and as approved by the Engineer.

In the event the Contractor overexcavates the trench depth, or if the trench width becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

9. Crushed Surfacing Top Course

- a. Measurement: Shall be measured per ton, in-place, based on truck tickets and shall be to the limits designated and approved by the Engineer.
- b. Payment: The unit price bid per ton for CRUSHED SURFACING TOP COURSE shall include all costs for the labor, material, and equipment associated with furnishing, installing, and testing crushed surfacing top course as shown on the Plans and as described in Section 02710.

10. Salvage and Demolition

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for SALVAGE AND DEMOLITION shall include all costs for labor, materials, and equipment required to salvage all indicated equipment as well as demolish and wastehaul the existing booster station building, reservoir, concrete play court,

fencing, and well pump, as well as any other items described herein and as shown on the Plans.

11. Sitework
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum contract price for SITEWORK shall include all costs for labor, materials, and equipment required to clear and grub and bring site to final grade as well as install catch basins, lids, grates, and outfalls as described herein and as shown on the Plans.

12. Filter and Booster Pump Building
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum contract price for FILTER AND BOOSTER PUMP BUILDING shall include all costs for labor, materials, and equipment to construct the booster pump building including, but not limited to excavation, structural fill, drainage system, concrete foundation, wood framing and sheathing, wood trusses, insulation, roofing, siding, trim siding, doors, all finish work including painting, HVAC, and hardware, as shown on the Plans and as specified herein.

13. Pyrolusite Filter Equipment and Backwash Assembly
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum price for PYROLUSITE FILTER EQUIPMENT AND BACKWASH ASSEMBLY shall include all costs for the labor, material, and equipment to furnish, install, and test the pyrolusite treatment plant system, including backwash flow meter, sight glass, and valve as shown on the Plans and as specified in Section 11246.

14. Booster Pump, 15 hp
 - a. Measurement: Shall be per each
 - b. Payment: The unit price bid per each BOOSTER PUMP, 15 HP shall include all costs for labor, materials, and

equipment to furnish, install, and test the pumps, motors, and accessories as shown on the Plans and specified in Section 11210.

15. Booster Pump, 30 hp
 - a. Measurement: Shall be per each
 - b. Payment: The unit price bid per each BOOSTER PUMP, 30 HP shall include all costs for labor, materials, and equipment to furnish, install, and test the pumps, motors, and accessories as shown on the Plans and specified in Section 11210.

16. Wellhouse Improvements
 - a. Measurement: Shall be per lump sum
 - b. Payment: The lump sum contract price for WELLHOUSE IMPROVEMENTS shall include all costs for labor, materials, and equipment to remove the existing well, motor, and column as well as furnish, install, and test the well column, discharge elbow, well pump, motor, and accessories as well as modifications to the well building including, but not limited to, foundation, framing, trusses, roofing, insulation, siding, doors, and finished work including painting, HVAC, and hardware as shown on the Plans and specified herein.

17. Backwash Recycle System
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum contract price for BACKWASH RECYCLE SYSTEM shall include all costs for labor, materials, and equipment to install backwash tanks and backwash recycle pump as shown on the Plans and described herein.

18. Piping, Valves and Appurtenances
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum contract price for PIPING, VALVES AND APPURTENANCES shall include all costs

for the labor, materials, and equipment to install piping, valves, and appurtenances both inside and outside including, but not limited to trench excavation, dewatering, bedding, backfilling, compaction, connecting to existing system, pipe penetrations, pipe, flow meters, chemical analyzers and mounting systems, water service, instrumentation, fittings, valves, control valves, pipe supports, thrust blocks, backfill, painting, disinfection and testing as shown on the Plans and as specified herein.

19. 90,000-Gallon Concrete Reservoir, Complete
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum contract price for 90,000-GALLON CONCRETE RESERVOIR, COMPLETE shall include costs for the labor, materials, and equipment required to provide and complete an operable concrete reservoir including but not limited to the foundation, inlet, outlet, drain, and overflow piping, reservoir, and appurtenances as shown on the plans and described herein. The contract price shall also include all required testing and disinfection as shown on the plans and described herein.

20. Generator and Automatic Transfer Switch
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum contract price for GENERATOR AND AUTOMATIC TRANSFER SWITCH shall include all labor, materials and equipment to furnish and install the Generator and automatic transfer switch, per the specifications and as required to provide complete backup power for the site as described in Divisions 13 and 16 of these Specification

21. Electrical, Telemetry and Instrumentation
 - a. Measurement: Shall be measured by lump sum.
 - b. Payment: The lump sum contract price for ELECTRICAL, TELEMETRY AND INSTRUMENTATION shall include all labor, materials and equipment to furnish electrical, telemetry, and instrumentation components of this Project

including conduit, wiring, motor control centers, panel boards, receptacles, fixtures, instrumentation, telemetry, and programming as shown on the Plans and as described in Divisions 13 and 16 of these Specifications. Costs shall also include all costs for demolition or abandonment of electrical components.

22. Restoration

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for RESTORATION shall include all costs for the labor, material, and equipment associated with cleanup, surface restoration, topsoil, and hydroseeding as shown on Plans and as specified in Section 02950.

23. Apprenticeship Incentive

- a. Measurement: Shall be measured by calculation.
- b. Payment: For the purpose of providing a common Proposal for all bidders, the Contracting Agency has entered an amount in the Proposal for Apprenticeship Incentive to become a part of the total bid by the Contractor. An incentive of \$2,000 will be assessed with the Final Payment for Contractors who meet the Apprentice Utilization Requirement without a reduction by Good Faith Effort, as described in Section 3.03.4(3.1) of the Supplementary General Conditions.

Where there are multiple schedules of work containing Apprenticeship Incentive items in the Proposal, the measurement by calculation for each incentive item will be based on the assessment of the entire project as a whole meeting the Apprentice Utilization Requirement without a reduction by Good Faith effort, rather than by schedule of work.

24. Apprenticeship Penalty

- a. Measurement: Shall be measured by calculation. Apprenticeship Hours will be measured for each hour of work performed by an apprentice as shown on the Monthly Apprentice Utilization Report, based on certified payrolls

or the affidavits of wages paid, whichever is least. The percentage is not rounded up.

- b. **Payment:** For the purpose of providing a common Proposal for all bidders, the Contracting Agency has entered an amount in the Proposal for Apprenticeship Penalty to become a part of the total bid by the Contractor, as described in Section 3.03.4(3.1) of the Supplementary General Conditions. When the Contractor fails to meet the Apprenticeship Requirement of 15 percent, a penalty will be assessed for a percentage range of unmet requirement, unless a Good Faith Effort is approved by the Contracting Agency.

Apprenticeship Penalty will be calculated as described below:

Percent of Requirement Met	Penalty
>90% to <100%	\$2.00
>75% to 90%	\$3.50
>50% to 75%	\$5.00
>0% to 50%	\$7.50
0%	\$10.00

Where there are multiple schedules of work containing Apprenticeship Penalty items in the Proposal, the measurement by calculation for each penalty item will be based on the assessment of the entire project as a whole meeting the Apprentice Utilization Requirement without a reduction by Good Faith effort, rather than by schedule of work.

The Contractor shall include all related costs in the unit Bid prices of the Contract, included but not limited to implementing, developing, documenting, and administering an apprenticeship utilization program, recording and reporting hours and all other costs to comply with this provision.

B. BID ADDITIVE 1: PERIMETER FENCING

1. Site Fencing and Gates

- a. Measurement: Shall be measured per linear foot.
- b. Payment: The unit contract price per lineal foot for SITE FENCING AND GATES shall include all labor, equipment, and materials to provide and install the fencing and gates as shown on the Plans and as specified in Section 02820.

1.5 PROJECT MATERIALS ON HAND

See General Conditions Section 3.04.12(6).

1.6 PAYMENT

Payment for all work will be made at the contract unit price or lump sum price as indicated in the Proposal, payment of which shall constitute full compensation, for a complete installation.

For items of equipment, acceptable operating and maintenance information shall be delivered to the Engineer before the Contractor will be paid for more than 90 percent of the purchase value of that equipment. Purchase value shall be the net price for the equipment as given on the invoice.

Final operating and maintenance manuals per Section 01300 must be delivered to the Engineer prior to the Project being 90 percent complete. Progress payments for work in excess of 90 percent completion will not be made until the specified acceptable operating and maintenance information has been delivered to the Engineer.

***** END OF SECTION *****

SECTION 01290

SCHEDULE OF VALUES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section establishes the procedures for preparing the schedule of values used for preparation of the Contractor's progress pay estimates.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
GC Section 3.04.12	Measurement and Payment
01200	Measurement and Payment
01300	Submittals

1.3 DESCRIPTION

Within 14 calendar days following receipt of Notice to Proceed, the Contractor shall submit to the Engineer, for review and approval, a complete breakdown of components of all lump sum bid items showing the value assigned to each portion of the work. The schedule of values shall be prepared in such form, and supported by data that substantiates its accuracy as may be required by the Engineer. This schedule of values shall, once approved by Engineer, be used as the basis for reviewing and determining each monthly progress payment estimate and as such shall be subject to periodic review by the Engineer to assure that the schedule of values reasonably represents, in the opinion of the Engineer, the actual value of the individual items of work to be performed. No payments shall be made until the schedule of values has been approved.

***** END OF SECTION *****

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes requirements that apply to all equipment and materials supplied on the Project.

The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the requirements of the Contract Documents. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment that are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Engineer in each case where their submittal may affect the work of another contractor or the Owner. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors and shall verify such coordination on all submittals.

Where noted in the Contract Documents, the structural, mechanical, and electrical designs associated with the indicated equipment items are specific to the manufacturer and model number specified. Any structural, mechanical, or electrical modifications required to utilize an approved substitution to the specified equipment shall be made by the Contractor at no additional cost to the Owner. Where approved substitutions of specified equipment affect other materials or equipment, mechanical, structural, or electrical work, the Contractor shall note in the equipment submittal any necessary changes to accommodate the substituted equipment. It shall also be the responsibility of the Contractor to coordinate other mechanical, structural, or electrical equipment submittals to make sure that all changes necessary to accommodate the substituted equipment are addressed in these submittals as well. See General Condition 3.04.3.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01720	Record Drawings
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 WORK INCLUDED

Submittals required for this work shall include any or all of the following as required by the particular specification section and the submittal schedule:

- A. Schedules and Plans
- B. **PRODUCT SUBMITTALS**
 - 1. Manufacturer's Literature
 - 2. Shop Drawings
 - 3. Color and Material Samples
 - 4. Design Calculations
 - 5. Test Reports
- C. Equipment Operation and Maintenance Manuals
- D. Record Drawings

1.4 SUBMITTAL INFORMATION

Shop, catalog, and other appropriate drawings and information shall be submitted to the Engineer for review prior to fabrication or ordering of all equipment and materials specified. The number of copies of submittal information to be submitted shall be as indicated below.

All submittal information shall be sent to the Engineer through the Contractor. The Contractor shall assign a separate submittal number to each item or group of items that relate to each specification section. Submittal numbers shall be assigned in consecutive ascending order, with the first project submittal assigned the number "1." Resubmittals shall be numbered using the same number followed by an alphabetical suffix. All submittals shall bear the Contractor's certification that they have reviewed, checked, and approved the submittal information prior to transmitting to the Engineer. The submittal number and related specification section shall be marked on each submittal.

PART 2 PRODUCTS

2.1 GENERAL

When the Contract Documents require a submittal the contractor shall submit the following number of documents.

Type of Submittal	Number of Copies
Schedules or Plans	5
Product Submittal	8
Design Calculations	5
Test Reports	5
Preliminary Equipment Manuals	3
Final Equipment Manuals	4

If requested by the Contractor and approved by the Engineer and Owner, the Contractor may submit one copy of submittals electronically in lieu of submitting hard copies for all submittals except Equipment Manuals. Hard copies of Equipment Manuals must be submitted. If submittals are provided electronically, only one reviewed copy will be returned to the Contractor.

2.2 PRODUCT SUBMITTALS

A. GENERAL

When indicated in the Contract Documents the contractor shall submit product data for review by the Engineer. Unless otherwise specified, within 30 calendar days after receipt of the submittal, the Engineer shall review the submittal and return three copies of the marked-up submittal. The reproducible original will be retained by the Engineer. The returned submittal shall indicate one of the following actions:

1. If the review indicates that the material, equipment, or work method complies with the project Specifications, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
2. If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED." The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be

incorporated in operation and maintenance data, a corrected copy shall be provided.

3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "AMEND AND RESUBMIT." Except at their own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted, and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."
4. If the review indicates that the material, equipment, or work method does not comply with the project Specifications, copies of the submittal will be marked "REJECTED - SEE REMARKS." Submittals with deviations that have not been identified clearly may be rejected. Except at their own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

B. MANUFACTURER'S LITERATURE

Where the contents of submitted literature include data not pertinent to the submittal, the portion(s) of the contents being submitted for the Engineer's review shall be clearly indicated.

C. SHOP DRAWINGS

Shop drawings shall be submitted in the form of blue-line or black-line prints of each sheet. Blueprint submittals will not be acceptable.

All shop drawings shall be accurately drawn to a scale sufficiently large enough to show pertinent features and method of connection or joining. On all shop drawings, figure dimensions shall be used as opposed to scaled dimensions.

D. COLOR AND MATERIAL SAMPLES

All material samples shall be of the exact article proposed to be furnished for the work and shall be submitted in the quantity required. Samples shall be returned to the Contractor, with one retained by the Engineer.

Unless the precise color is specifically described in the Contract Documents, or whenever a choice of color or pattern is available in a specified product, accurate color charts shall be submitted to the Engineer for their review and selection.

E. DESIGN CALCULATIONS

Where required in the Specifications, design calculations shall be submitted to the Engineer. Design calculations shall be complete, concise, and in an easy-to-read format. All design calculations shall be stamped by a Professional Engineer licensed in the State of Washington.

F. TEST REPORTS

Copies of all test reports shall be submitted to the Engineer.

2.3 EQUIPMENT MANUALS

A. GENERAL

For all items of equipment, manufacturer's equipment operation and maintenance manuals shall be submitted to the Engineer for review. One copy will be returned to the Contractor with comments.

The following information shall be furnished for all items of equipment installed on the project requiring operational and/or maintenance procedures, and for any additional items indicated by the Engineer.

1. Lubrication Information

This shall consist of the manufacturer's recommendations regarding the lubricants to be used and the lubrication schedule to be followed.

2. Electrical and Control Diagrams

Diagrams shall show internal and connection wiring.

3. Startup Procedures

These instructions consist of equipment manufacturer's recommendations for installation, adjustment, calibration, and troubleshooting.

4. Operating Procedures

These instructions consist of the equipment manufacturer's recommended step-by-step procedures for starting, operating, and stopping the equipment under specified modes of operation.

5. Preventive Maintenance Procedures

These instructions consist of the equipment manufacturer's recommended steps and schedules for maintaining the equipment.

6. Overhaul Instructions

These instructions consist of the manufacturer's directions for the disassembly, repair, and reassembly of the equipment and any safety precautions that must be observed while performing the work.

7. Parts List

This list consists of the generic title and identification number of each component part of the equipment.

8. Spare Parts List

This list consists of the manufacturer's recommendations of number of parts, which should be stored by the Owner and any special storage precautions, which may be required.

9. Exploded View

Exploded or cut views of equipment shall be provided if available as a standard item of the manufacturer's information. When exploded or cut views are not available, plan and section views shall be provided with detailed callouts.

10. Test Documentation

Reports, records, data and forms documenting the results of equipment factory tests, including pump and blower performance curves, shall be provided, with the operating points for the specific equipment designated. When a special factory test of the supplied equipment is not performed, the manufacturer's standard performance reports and curves, with specified operating points, shall be provided for the supplied equipment.

11. Specific Information

Where items of information not included in the above list are required, they will be provided as described in the specifications for the equipment.

12. Warranty Information

13. Maintenance Information Summaries

In addition, the following items of equipment shall be provided with Maintenance Information Summaries in each appropriate section of the equipment manuals, prepared according to the format specified herein:

- Iron and Manganese Filtration System
- Well Pump
- Finish Water (High Flow) Pump
- Finish Water (Duty) Pumps
- Backwash Recycle Pump
- Flow Meters
- Heating and Ventilation Equipment
- Valves (larger than 1-inch in size)
- Float Switches
- Plant Instrumentation, Telemetry and Control Equipment
- Electrical Equipment

Maintenance information summaries shall be prepared on 8-1/2-inch x 11-inch paper only and shall contain the following information compiled from manufacturer's recommendations in the order shown.

1. Description or name of item of equipment.
2. Manufacturer.
3. Name, address, and telephone number of local manufacturer's representative.
4. Serial number (where applicable). The Contractor shall verify that it matches the equipment installed on the project.
5. Equipment nameplate data including model number.

6. Recommended maintenance procedures:
 - a. Description of procedures.
 - b. Maintenance frequency required.
 - c. Lubricant(s) or other materials required (where applicable), including type of lubricant, lubricant manufacturer, and specific compound.
 - d. Additional information as required for proper maintenance.

7. Recommended spare parts.

The maintenance information summary shall be placed at the beginning of the manual.

All operation and maintenance information shall be comprehensive and detailed, and shall contain information adequately covering all normal operation and maintenance procedures.

For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment specification number as it appears in the project Specifications. The information shall be organized in binders. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information.

Lubricants shall be described in detail, including type, recommended manufacturer, and manufacturer's specific compound to be used.

It shall be the responsibility of the Contractor to ensure that all operation and maintenance materials are obtained. Material submitted must meet the approval of the Engineer prior to project acceptance.

B. EXTRANEIOUS DATA

Where the contents of the manuals include manufacturers' standard brochures or catalog pages, the exact item(s) used in this installation shall be clearly indicated and all manufacturers' data which is extraneous shall be clearly deleted.

C. FINAL EQUIPMENT MANUALS

The Contractor shall be responsible for tracking and coordinating each separate manufacturer's equipment operation and maintenance manual submittal and shall resubmit, as necessary, until the Engineer's review indicates that the submittal is acceptable. The Contractor shall maintain equipment manual files until final approval copies are delivered to the Engineer. The Contractor shall be responsible for collating the approved operation and maintenance submittal sections into complete final manufacturers' equipment operation and maintenance manuals bound in post binders which are indexed to the Specifications. The Contractor shall deliver the complete final operation and maintenance manuals to the Engineer prior to project completion. All copies final manufacturers' equipment manuals submitted will be retained by the Engineer or Owner.

The Contractor shall also supply three USB copies of the final equipment manuals in a tabbed, searchable, .pdf format, with a table of contents bookmarked to provide a navigation link to each section of the manual.

PART 3 EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

A. GENERAL

Each submittal shall be accompanied by a letter of transmittal showing the date of transmittal, specification section, or drawing number to which the submittal pertains, submittal number, and a brief description of the material submitted.

B. RESUBMITTALS

When material is resubmitted for any reason, it shall be submitted under a new letter of transmittal and referenced to the previous submittal.

3.2 REVIEW OF SUBMITTALS

The Engineer will review all submittals for general conformance with the design and other requirements of the Contract Documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the Contract Documents. Submittals may be rejected based on inadequate information and/or not meeting the requirements of the Contract Documents. Rejection of submittals requires action on the part of the Contractor to correct the reason for the rejection. The Contractor remains responsible for details and accuracy, for confirming and

correlating all quantities and dimensions, for selecting fabrication processes, and for techniques of assembly and installation.

3.3 COORDINATION OF PRODUCT SUBMITTALS

A. GENERAL

Prior to submittal for review by the Engineer, all data shall be fully coordinated, including the following:

1. All field dimensions and conditions.
2. All trades and public agencies involved, including necessary approvals.
3. All deviations from the Contract Documents.

B. GROUPING OF SUBMITTALS

1. All submittals shall be grouped with associated items, unless otherwise specifically permitted by the Engineer.
2. The Engineer may reject the submittals in their entirety or any part thereof, if not in accordance with the Contract Documents.

C. CERTIFICATION

Submittals shall bear the Contractor's certification that they has reviewed, checked, and approved the shop drawings prior to forwarding them to the Engineer.

3.4 TIMING OF PRODUCT SUBMITTALS

A. GENERAL

1. All submittals shall be made far enough in advance of installation to provide all required time for reviews and securing necessary approvals.
2. In scheduling, the Contractor shall allow for the time indicated in Part 2.2A for the Engineer's review following their receipt of the submittal.

B. DELAYS

No additional or separate payment will be made for costs of delays occasioned by tardiness of submittals on the part of the Contractor.

3.5 EQUIPMENT MANUALS

The preliminary copies of the manufacturer's equipment manuals shall be delivered to the Engineer for review not later than the time of equipment delivery to the project site.

Prior to submittal of the final equipment manuals, the Contractor shall check the manuals for accuracy and completeness and shall verify that prior review comments have been addressed.

***** END OF SECTION *****

SECTION 01310

PROJECT MEETINGS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes information pertaining to the various meetings that will be held during the course of constructing this project.

1.2 PRECONSTRUCTION CONFERENCE

As soon as possible following the award of the Contract, a preconstruction conference shall be scheduled for representatives of the Owner, the Contractor, the Engineer, funding agencies, regulatory agencies, and affected utilities.

1.3 PROJECT PROGRESS MEETINGS

The Owner and the Engineer will schedule and attend regular weekly meetings with the Contractor for coordination, administrative, and procedural requirements of the project. These meetings may occur virtually or in person. In the event of in person meetings, progress meetings shall be held at or near the project site

1.4 CONSTRUCTION MEETINGS

The Contractor shall schedule and hold regular meetings during the project:

- A. Safety Meetings (Contractor's subcontractors shall attend if they are working onsite.)
- B. Project Progress Meetings
- C. Equipment Installation Meetings
- D. Coordination Meetings
- E. Startup and Testing Meetings

The Contractor shall notify the Owner and Engineer in advance of all meetings. The meetings may or may not be attended by the Owner and Engineer.

***** END OF SECTION *****

SECTION 01320

PROGRESS SCHEDULES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section further defines the progress schedule requirements described in the General Conditions Section 3.04.15(1). This Section specifies the procedures for preparing and revising the cost-loaded construction schedule used for planning and managing construction activities. The schedule provides a basis for determining the progress status of the project relative to the completion time, specific dates, and for determining the acceptability of the progress payment estimates.

1.2 DESCRIPTION

The Contractor shall prepare a time-scale network schedule using a critical path method (CPM). A general guide for preparing such a schedule is contained in “The Use of CPM in Construction, a Manual for Contractors and the Construction Industry,” published by the Associated General Contractors of America.

The schedule shall depict all significant construction activities and all items of work listed in the breakdown of contract prices submitted by the Contractor. Assigned values for each part of the work shall be indicated. The dependencies between activities shall be indicated so that it may be established what effect the progress of any one activity has on the schedule.

Completion time and all specific dates and sequencing requirements shall be shown on the schedule. Activities making up the critical path shall be identified.

No activity on the schedule shall have a duration longer than 14 consecutive days or an assigned value greater than \$25,000, except activities comprising only fabrication and delivery, which may extend for more than 14 consecutive days. Activities which exceed these limits shall be divided into more detailed components. The scheduled duration of each activity shall be based on the work being performed during the normal 40-hour workweek with allowances made for legal holidays and normal weather conditions.

1.3 SUBMITTALS

The CPM Progress Schedule shall be prepared using a computerized system. The schedule shall be submitted in the form of an arrow diagram or precedence diagram with activity listings. The following shall be included:

- A. Network diagram shall show in detail and in order of sequence all significant activities, their descriptions, durations, and dependencies, as necessary and as required to complete all work and each separate part of the work.
- B. The activity listing shall show the following information for each activity shown on the network diagram:
 - 1. Description
 - 2. Duration
 - 3. Start and finish dates
 - 4. Total float time and free float time
- C. Milestone activity completions shall be shown and clearly defined.
- D. The critical path shall be clearly indicated.
- E. A legend defining any abbreviations used on the schedule shall be provided.
- F. All CPM schedules shall conform to the requirements of the Owner's overall Project schedule and the Contract Documents.

The Contractor shall submit four hard copies (bluelines or blacklines) plus an electronic file with each schedule submittal. The hard copies shall be full size (22" x 34") and the electronic copy shall be in pdf format. Electronic files may also be viewable using Microsoft Project®. All schedule reports shall be 8-1/2-inch x 11-inch format. The Contractor shall provide, in chronological order, a list of constraints used, if any, in the preparation of the schedule.

Within 14 calendar days after receipt of the schedule, the Owner and Engineer will return a copy of the schedule to the Contractor with comments. Review of the schedule is for purposes of evaluating the Contractor's ability to complete the Work within the Contract time. Review shall not constitute approval or acceptance of the Contractor's construction means, methods, or sequencing.

The Contractor shall submit an updated Progress Schedule with each application for payment or whenever actual construction progress deviates significantly from the current schedule.

***** END OF SECTION *****

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the control tests, test sample collection, required field-testing, and special inspections as specified herein, and indicated on the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
02300	Earthwork
02700	Gravel Materials
02710	Gravel Surfacing
03300	Reinforced Concrete

1.3 PAYMENT

All testing as required by this Section shall be paid for by the Contractor. All costs to prepare and implement the sample and testing program shall be included in the bid prices for the various items associated with the sampling and testing program.

Retesting and reinspection required because of defective work and testing performed for the convenience of the Contractor shall also be paid for by the Contractor.

Testing requirements shall not be cause for claims of delay by the Contractor and all expenses accruing therefrom shall be deemed incidental to the performance of the Contract.

PART 2 PRODUCTS

2.1 GENERAL

The Contractor shall be responsible for all material testing specified in the Contract Documents and any applicable permits and codes. The materials testing laboratory shall be accredited for performing the various testing methods either by AASHTO R18, AASHTO 150/IEC 17025 or the American Association for Laboratory Accreditation and further approved by the Owner. The materials testing laboratory shall send test results directly to the Engineer.

2.2 EARTHWORK AND GRANULAR MATERIALS

A. COMPACTION CONTROL

Optimum moisture content and maximum density tests shall be determined by the following method:

ASTM D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort

B. IN-PLACE TESTS

In-place density and moisture content tests shall be made by an independent testing laboratory according to the following methods:

ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

2.3 AGGREGATES

All aggregates shall be tested in accordance with applicable WSDOT test methods:

<u>Title</u>	<u>Test Method</u>
Sampling	AASHTO T2
Sieve Analysis of Fine and Coarse Aggregates	104A
Material Finer than No. 200 Sieve in Aggregates	102A
Percentage of Particles Smaller than 0.025 mm and 0.005 mm	603A
Organic Impurities	111A
Abrasion of Coarse Aggregates by Use of the Los Angeles Machine	101A
Sand Equivalent	109A

2.4 CAST-IN-PLACE CONCRETE

Cast-in-place concrete shall be tested in accordance with applicable parts of Chapter 16 of ACI 301. Concrete reinforcement and concrete special inspections

shall be performed in accordance with local Building Official and WABO requirements.

PART 3 EXECUTION

3.1 SAMPLING AND TESTING FREQUENCY

A. GENERAL

The Contractor shall provide the following quality control tests at the number and frequency described herein. On-site testing technicians and testing laboratories shall be WABO-certified. The precise location of the tests shall be designated by the Engineer. The Contractor shall cooperate with laboratory personnel employed to conduct the density testing, sampling of material(s), and special inspections. The Contractor shall provide safe access within the work site for laboratory personnel such that density testing and visual inspection can be performed. The Contractor shall provide samples of materials to be tested in the quantities required and herein specified to the appropriate laboratory personnel. The Contractor shall furnish all labor, equipment, tools, and materials necessary to obtain and deliver samples as herein designated. They shall also provide and repair any test holes required in order to facilitate the testing and sampling and to provide for the testing laboratory's exclusive use for storage and curing of test samples until removed to the laboratory.

Any areas tested and further failing compliance with the Specifications shall be recompacted and retested at the Contractor's expense, until a successful density test indicating compliance with these Specifications has been achieved.

B. SOIL TESTING

The following soil quality control tests shall be completed at the given frequency:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Backfill for foundations, walls, trenches and roads	Gradation ¹	One every 500 cy or one per day for quantities exceeding 25 cy. For trenches, one every 750 feet of trench.

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
	In-Place Density ^{2,3,4}	One every 500 cy or one per day for each type of soil or fill material with quantities exceeding 25 cy. For trenches, one per day and one every 250 feet of trench.
	Moisture-Density Relationship ³	One prior to start of backfilling operation, one every 20 densities and any time material type changes.
Pipe Bedding	Gradation ¹	One every 750 feet of trench.
Subgrade and Fills	In-Place Density ^{2,3}	One every 500 cy of each type material.
	Moisture-Density Relationship	One for every 20 densities for each material.
	Gradation	One for every moisture-density.

1. All acceptance tests shall be conducted from in-place samples.
2. Additional tests shall be conducted when variations occur due to the Contractors, operations, weather conditions, site conditions, etc.
3. The nuclear densometer, if properly calibrated, may be used but only to supplement the required testing frequency and procedures. The densometer shall be calibrated and is recommended for use when the time for complete results becomes critical.
4. Depending on soil conditions, it is anticipated that compaction tests shall be required at depths of 2 feet above the pipe and at each additional 5 feet to the existing surface plus a test at the surface.

C. CONCRETE TESTING

All testing shall conform to applicable portions of ACI. Special inspections of concrete and concrete reinforcement shall comply with WABO requirements.

All concrete must meet the specified requirements for minimum 28-day compressive strength.

All concrete cylinders shall be molded and tested for strength by an independent testing laboratory employed by the Contractor.

The Contractor shall furnish all concrete required for molding of the cylinders. In cases where cylinders are stored at the project site, the Contractor shall provide storage and protection for the cylinders in accordance with ACI requirements.

Concrete tests and testing frequency shall be in accordance with the more stringent of the testing requirements specified in Section 03300-3.17 of these Specifications, and the following table:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Coarse Aggregate (for each grading size) ¹	Gradation	One test every 500 cy of concrete.
	Deleterious Substances	One test initially and thereafter when appearance makes the material suspect.
	L.A. Abrasion	One every 2,000 tons of aggregate.
	Moisture specific gravity and absorption ¹	One initially and every 250 cy thereafter. One moisture to be conducted prior to any batching and more frequently if hauling and storage does not provide a consistent moisture content.
Fine Aggregate ¹	Gradation and fineness modules	One every 250 cy of concrete.
	Deleterious Substances	(same as coarse aggregate).
	Moisture, specific gravity and absorption ¹	(same as coarse aggregate).
Concrete	Slump	Conduct one test every day of placement and one additional test for every 50 cy placed and more frequently if batching appears inconsistent. Conduct in conjunction with taking concrete cylinders.
	Entrained Air	Conduct with each slump test.
	Ambient and concrete temperatures	Conduct with each slump test.

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Concrete	Compressive strength and evaluation of results per ACI 214. (includes unit weight of each cylinder)	For all concrete placement, take one set of four cylinders per day and one additional set of cylinders for every 50 cy of each class of structural concrete. Cylinders shall be 4 inch by 8 inch. Test one cylinder at 7 days and two at 28 days. Fourth cylinder shall be held in reserve. A plot and statistical evaluation shall be maintained in accordance with ACI 214 for compressive strength results. Field cure cylinders shall be made when insitu strengths are required to be known.

1. Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement (w/c) calculations.

D. SPECIAL INSPECTIONS

Contractor shall perform all required Special Inspections per WABO requirements (Chapter 17 of the IBC). Special inspections include, but are not limited to, cast-in-place concrete, concrete reinforcement, structural welded connections, bolted connections, compaction testing for building and structure foundations, and epoxy adhesive bolting.

***** END OF SECTION *****

SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary facilities required for this project, but not necessarily limited to:

- A. Temporary utilities such as water, electricity, telephone, off-site staging, and off-site parking.
- B. Temporary piping, pumps, valves, fittings, vaults, and appurtenances necessary to keep existing facilities fully operational during construction.
- C. Sanitary facilities.
- D. Temporary enclosures such as fences, tarpaulins, barricades, and canopies.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01510	Maintenance of Treatment Facility
01520	Field Offices and Storage Sheds

PART 2 PRODUCTS

2.1 UTILITIES

A. TEMPORARY ELECTRICITY

The Contractor shall provide temporary power for construction at the project site. They shall make arrangements with the electrical utility (to obtain temporary power) and shall pay all costs and fees charged by the utility associated with connection of temporary power. The Contractor shall provide all special connections, receptacles, panelboards, etc., which are required for temporary service, and are not provided by the utility.

The Contractor shall furnish and install all temporary wiring and associated equipment required to keep all portions of the existing facilities in operation at all times.

Area distribution boxes shall be furnished, installed, and so located that the individual trades may use their own construction-type extension cords to obtain proper power and artificial lighting at all points where required. The Contractor shall provide a main disconnect on all temporary wiring panels, labeled "MAIN DISCONNECT," to ensure the safety of personnel using extension cords and hand tools. Panels shall also be properly grounded and equipped with GFCI breakers in accordance with WISHA requirements.

The Contractor shall provide the Engineer single line diagrams of the temporary wiring showing all circuit breakers. These diagrams shall be provided prior to installation of this wiring. These diagrams are necessary to provide information to Owner personnel for off-hours operation.

The Contractor shall pay all demand, consumption, taxes, and fees associated with the temporary electrical service.

B. WATER

The Contractor shall be responsible for providing water necessary for construction. This includes costs for supplying potable water for hydrostatic pressure leak testing of all water-holding structures and operational testing of all equipment and processes. Water is available from the Owner free of charge, provided that it is used responsibly. The Contractor shall install a meter with backflow prevention device prior to obtaining water from the Owner.

2.2 SANITARY FACILITIES

The Contractor shall provide toilet and wash-up facilities for their workforce and the Engineer at the site of work. They shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

2.3 OFF-SITE STAGING AND PARKING

The Contractor shall note that space is limited throughout the construction site. Employees of the Contractor, all subcontractors, vendors, suppliers, and associated personnel shall not be allowed to park onsite during the course of construction without prior approval from the Owner. It shall be the responsibility of the Contractor to provide sufficient parking facilities in authorized area(s) other than the construction site for the above-mentioned personnel.

The Contractor shall not be allowed to stockpile and store equipment and materials throughout the construction site. The Contractor shall coordinate their

schedule so that all equipment and materials shall be brought to the construction site only when they are to be installed/utilized.

The Contractor shall provide storage of equipment and materials at an offsite, bonded warehouse, to be approved by the Engineer. The Contractor shall pay all costs associated with off-site delivery, storage, and transfer to the construction site.

2.4 ENCLOSURES

The Contractor shall furnish, install, and maintain during the project time all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of the work in compliance with all pertinent safety and other regulations.

PART 3 EXECUTION

All temporary facilities and controls shall be maintained as long as required for the safe and proper completion of the work. The Contractor shall remove such temporary facilities and controls as rapidly as progress of the work will permit or as directed by the Owner.

***** END OF SECTION *****

SECTION 01505

MOBILIZATION AND DEMOBILIZATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of mobilization and demobilization. Mobilization consists of preconstruction activities and preparatory work for the project necessary to mobilize labor, materials, and equipment to the project site. Demobilization consists of activities to remove materials and equipment from the project site upon project completion, including final cleanup. Items which are not considered mobilization or demobilization include but are not limited to:

- A. On-going activities throughout the duration of construction.
- B. Profit, interest on borrowed money, overhead, or management costs.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
Division 1	General Technical Requirements

PART 2 PRODUCTS

Products and materials required for mobilization and demobilization are described in the various sections of Division 1 and in other parts of the Contract Documents.

PART 3 EXECUTION

Complete mobilization and demobilization as required by the various sections of Division 1 and other parts of the Contract Documents.

***** END OF SECTION *****

SECTION 01510

MAINTENANCE OF TREATMENT FACILITY

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the steps that the Contractor shall take to ensure that the existing facilities or temporary facilities remain fully operational during all stages of construction and modifications to the various existing facilities.

This shall also include all connections of temporary pumping equipment with temporary electrical service with controls. The Contractor shall coordinate work efforts with the Owner.

To ensure continuous operation of the existing treatment systems, the Contractor shall inform the treatment plant operator of the details of operation of all temporary piping and electrical power and controls.

1.2 EXISTING WELL, RESERVOIR, AND PUMP STATION

The existing facilities provide the sole water source for the Shadowood development. During the work specified herein, the existing well, reservoir, and pump station must remain operational. The number, length, and condition of outages are listed below:

- The well pump shall only be taken off-line for only 8 hours, provided there has been coordination with the Owner 48-hours in advance of the shutoff.
- The Reservoir cannot be taken offline until the new reservoir and pump station are complete.
- The pump station cannot be taken offline until the new reservoir and pump station are complete.

***** END OF SECTION *****

SECTION 01520

FIELD OFFICES AND STORAGE SHEDS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section describes the requirements for field offices on this project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01500	Temporary Facilities

PART 2 PRODUCTS

2.1 STORAGE SHEDS

The Contractor shall provide storage for the protection of equipment, materials, supplies, and tools and shall ensure that a building be used for the storage of materials that deteriorate when exposed to moisture. Workshops and storage buildings shall be located in the general area of the work and shall be clean and in proper order. Storage of materials at the project sites shall not obstruct access or use by the Owner's employees of existing facilities.

PART 3 EXECUTION

All storage sheds shall be maintained as long as required for the safe and proper completion of the work. The Contractor shall remove such temporary facilities as rapidly as progress of the work will permit or as directed by the Engineer. The Engineer's field office and accessories shall remain in service until the project is accepted by the Owner.

***** END OF SECTION *****

SECTION 01720

RECORD DRAWINGS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the record drawings, which shall be maintained and annotated by the Contractor during construction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals

1.3 INFORMATION PROVIDED BY THE OWNER

The Contractor will be provided with the following items to maintain record drawings for the project:

- A. One full size paper set of Plans.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall maintain the following record drawings for the project:

- A. A neat and legibly marked set of Contract Plans showing the final location of piping, equipment, electrical conduits, outlet boxes and cables;
- B. Additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the Contract Documents; and
- C. Contractor layout and installation drawings.

Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the Engineer during normal working hours at the Contractor's field office. At the completion of the

work, prior to final payment, all record drawings shall be submitted to the Engineer.

Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:

- A. Additions - Red
- B. Deletions - Green
- C. Comments - Blue
- D. Dimensions - Graphite

Legibly mark drawings to record actual depths, horizontal and vertical location of underground raceways, cables, and appurtenances referenced to permanent surface improvements.

The Contractor's record drawings (full-size hard-copy) will be reviewed monthly for completeness by the Engineer prior to preparing the progress estimate for payment. If the record drawings do not reflect the work performed, payment for that item of work will not be included in the progress estimate.

***** END OF SECTION *****

SECTION 01740

CLEANUP

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the maintenance of the building, structures, and site(s) in a standard of cleanliness throughout the construction period as described herein.

Throughout the construction period, the Contractor shall maintain the cleanliness of the site and structures as described herein. The Contractor is also to maintain access to all existing, operating equipment such that the equipment may be serviced and operated.

Dust of all kinds, including concrete dust produced by construction activities, shall be controlled to avoid damage to existing, operating equipment. Enclosures, ventilation, and air scrubbing may be required where significant potential for damage is determined by the Engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

In addition to standards described in this Section, comply with all requirements for cleaning up when described in other sections of these Contract Documents.

1.3 QUALITY ASSURANCE

A. INSPECTION

The Contractor shall conduct daily site inspections, and more often if necessary, to verify that requirements are being met.

B. CODES AND STANDARDS

In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 COMPATIBILITY

Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Engineer.

PART 3 EXECUTION

3.1 PROGRESS CLEANING

A. GENERAL

Retain all stored materials and equipment in an orderly fashion allowing maximum access, not impeding drainage or traffic, and providing protection.

Do not allow the accumulation of scrap, debris, waste material, and other items not required for this work.

At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the project site.

Provide adequate storage for all materials awaiting removal from the project site, observing all requirements for fire protection and protection of the environment.

B. SITE

Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often if necessary, inspect all arrangements of materials stored on the site, restack, arrange, or otherwise service all arrangements to meet the requirements above.

Maintain the site in a neat and orderly condition at all times so as to meet the approval of the Engineer.

C. STRUCTURES

Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often if necessary, sweep clean all interior spaces. “Clean” shall be interpreted to mean free from dust and other materials that can be swept with a broom using reasonable diligence.

In preparing to install succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material. Use all equipment and materials required to achieve the required cleanliness.

D. STREETS

All paved and unpaved streets in the vicinity of the project shall be kept free of material tracked from the project site(s) or dropped from vehicles entering and leaving the site(s). The Contractor shall inspect roads in each active area daily, and all material deposited on the road from the Contractor’s activities shall be removed prior to the end of the workday. This shall include sweeping, as required, to collect any mud, dirt and dust from the surface. All catch basins and culverts in the work area shall be inspected before completion and cleaned as directed by the Engineer.

3.2 FINAL CLEANING

A. DEFINITION

Except as otherwise specifically provided, “clean” shall be interpreted as meaning the level of cleanliness generally provided by commercial building maintenance equipment and materials.

B. GENERAL

Prior to final inspection, remove from the jobsite all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final project cleaning as described below.

C. STRUCTURES

1. Exterior

Visually inspect all exterior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with

water, the Engineer may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Interior

Visually inspect all interior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains, and dirt from finished surfaces. Use only appropriate cleaning materials and equipment.

3. Glass

Clean all glass inside and outside.

D. TIMING

Schedule final cleaning as approved by the Engineer to enable the Owner to accept a completely clean project, ready for occupancy.

***** END OF SECTION *****

SECTION 01800

TESTING, COMMISSIONING, AND TRAINING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation, testing, commissioning, and training for all mechanical, electrical, and instrumentation systems and completed portions of the work.

See also Section 16050 for additional electrical and instrumentation system testing requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01110	Scope of Work
01300	Submittals
01400	Quality Control
01500	Temporary Facilities
15050	Piping Systems
15700	HVAC
16050	Basic Electrical Materials and Methods

1.3 QUALITY ASSURANCE

A. INSTALLATION

All mechanical, electrical, and instrumentation equipment provided under this Contract shall be installed in conformity with the Contract Documents, including the manufacturer's requirements. Should a manufacturer's installation recommendation conflict with specific requirements of this Contract Document, the Contractor shall bring the matter to the attention of the Engineer. Any additional costs arising out of changes authorized by the Engineer to accommodate manufacturer's installation recommendations will be considered extra work. Any costs incurred by the Contractor through failure to timely notify the Engineer of a difference between Contract Document and manufacturer's installation requirements shall be borne by the Contractor.

B. TESTING

1. General Requirements

All equipment and partially complete or fully completed portions of the work included in this Contract shall be tested and inspected to prove compliance with the Contract requirements. Unless otherwise specified, all costs of testing, including temporary facilities and connections, shall be borne by the Contractor. For the purpose of this Section, equipment shall mean any mechanical, electrical, instrumentation, or other device with one or more moving parts or devices requiring an electrical, pneumatic, or hydraulic connection. Installed leakage tests and other piping tests shall be as specified in Sections 15050. Installed tests for heating and ventilation systems shall be as specified in Section 15700. Installed tests for electrical and instrumentation devices and systems shall be in accordance with Division 16.

No tests specified herein shall be applied until the item to be tested has been inspected and approval given for the application of such test.

Tests and inspection shall include:

- a. The delivery acceptance test and inspections.
- b. The installed tests and inspections. These tests may be performed with water or the process fluid, as described in the accepted test plan.
- c. The operational testing of completed sections of the facility. These tests may be performed with water or the process fluid, as described in the accepted test plan.
- d. The commissioning of completed sections of the facility by Owner's personnel. The commissioning shall be performed with the process fluid at normal flows.

Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry. The Contractor shall see that scheduling and performance of all tests are coordinated with involved subcontractors and suppliers. The Contractor shall allow for up to two additional setpoint changes during testing. No extra costs or time allowances shall be provided as long as this setpoint allowance is not exceeded.

The form of evidence of satisfactory fulfillment of delivery acceptance test and inspection requirements shall be, at the discretion of the Engineer, either by tests and inspections carried out in their presence or by certificates or reports of tests and inspections carried out by approved persons or organizations. The Contractor shall provide and use forms that include all test information, including specified operational parameters. The content of the forms used shall be acceptable to the Engineer.

A master test log book shall be maintained by the Contractor, which shall cover all tests including piping, equipment, electrical, and instrumentation. The master test log book shall be provided with loose-leaf pages that shall be copied weekly after updating for transmittal to the Engineer. The master test log book shall be transmitted to the Engineer upon completion of the project.

2. Delivery Acceptance Tests and Inspections

The delivery acceptance tests and inspections shall be at the Contractor's expense for any equipment specified herein and shall include the following:

- a. Test of items at the place of manufacture during and/or on completion of manufacture, comprising hydraulic pressure tests, electric and instrumentation subsystems tests, performance and operating tests and inspections in accordance with the relevant standards of the industry and more particularly as detailed in individual clauses of these Specifications to satisfy the Engineer that the items tested and inspected comply with the requirements of this Contract. Tests other than those specified shall be in accordance with Section 01400.
- b. Inspection of all items delivered at the site or to any authorized place of storage so that the Engineer may be satisfied that such items are of the specified quality and workmanship and are in good order and condition at the time of delivery. The Contractor shall be prepared to remove all coverings, containers, or crates to permit the Engineer to conduct their inspection. Should the Engineer find, in their opinion, indication of damage or deficient quality of workmanship, the Contractor shall provide the necessary documentation or conduct such tests deemed necessary by the Engineer to demonstrate compliance.

3. Installed Tests and Inspections

a. General

All equipment shall be tested by the Contractor to the satisfaction of the Engineer before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned, adjusted and connected. Any changes, adjustments, or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the work.

b. Procedures

i. General

The procedures shall be divided into two distinct stages; preoperation checkout and water test. Testing procedures shall be designed to duplicate, as nearly as possible, all conditions of operation and shall be carefully selected to ensure that the equipment is not damaged. Once the testing procedures have been reviewed and approved by the Engineer, the Contractor shall produce checkout, alignment, adjustment and calibration sign-off forms for each item of equipment to be used in the field by the Contractor and the Engineer jointly to ensure that each item of electrical, mechanical and instrumentation equipment has been properly installed and tested. The Contractor is advised that failure to observe these precautions may place the acceptability of the subject equipment in question.

ii. Preoperation Checkout

The installed tests and inspection procedures shall incorporate all requirements of these Specifications and shall proceed in a logical, step-wise sequence to ensure that all equipment has been properly serviced, aligned, connected, calibrated, and adjusted prior to operation. Preoperation checkout procedures shall include, but not necessarily be limited to:

- (1) Piping system pressure testing and cleaning as specified in Division 15.
- (2) Electrical system testing as specified in Division 16.
- (3) Alignment of equipment.
- (4) Preoperation lubrication.

iii. Water Test

Once all affected equipment has been subjected to the required preoperational checkout procedures and the Engineer has witnessed and has not found deficiencies in that portion of the work, individual systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these Specifications. Test media for these systems shall either be the intended fluid or a compatible substitute. The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including temperatures and vibration, to observe performance characteristics, including performance throughout the specified range for blowers, and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary systems such as electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, the Contractor shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system, at no additional cost to the Owner. Disposal methods for test media shall be subject to review by the Engineer.

If under test, any portion of the work should fail to fulfill the Contract requirements and is adjusted, altered, renewed or replaced, tests on that portion when so adjusted, altered, removed or replaced, together with all other portions of the work as are

affected thereby, shall, if so required by the Engineer, be repeated within reasonable time and in accordance with the specified conditions. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner as a result of repeating such tests.

Once simulated operation has been completed, all machines shall be rechecked for proper alignment, realigned, if necessary, and doweled in place. All equipment shall be checked for loose connections, unusual movement, excessive temperature, noise, and/or vibration or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Engineer. All machines or devices, which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. They shall then be repaired or removed from the site and replaced at no cost to the Owner.

Test results shall be within the tolerances set forth in the detailed Specification sections of the Contract Documents. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory installed test, any doubt, dispute, or difference should arise between the Engineer, and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then, the Engineer may order the test to be repeated. If the repeat test, using such modified methods or equipment as the Engineer may require, substantially confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner otherwise the costs shall be borne by the Contractor. Where the results of any installed test fail to comply with the Contract requirements for such test, then such repeat tests as may be necessary to achieve the Contract requirements shall be conducted by the Contractor at their expense.

Unless otherwise specified, the Contractor shall provide at no expense to the Owner, all water,

power, fuel, compressed air supplies, labor and all other necessary items and work required to complete all tests and inspection specified herein. The Contractor shall provide, at no expense to the Owner, temporary heating, ventilating, and air conditioning for any areas requiring it in the case where permanent facilities are not complete and operable at the time of installed tests and inspections. Temporary facilities shall be maintained until permanent systems are in service.

4. Operational Testing

After completion of all installed testing and review by the Engineer that all equipment complies with the requirements of the Specifications, the Contractor shall conduct operational testing. All domestic water, oil, fuel, and chemical systems shall be filled with the specified fluid.

The Contractor shall operate the completed facility for a period of not less than that specified in Part 3.4 of this Section during which all systems shall be operated as a complete facility at various loading conditions, as directed by the Engineer. Should the operational testing period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, or the Contractor's temporary testing systems, the operational testing program shall be repeated until the specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, and flow.

Record drawings of facilities involved must be accepted and ready for turnover to the Owner at the time of operational testing.

All costs for water, fuel, power, and chemicals required during operational testing shall be borne by the Owner.

5. Commissioning

After completion of the operational testing and certifications by the Engineer that the systems meet all performance requirements, commissioning will begin. The commissioning period for all systems shall be 14 days. The Contractor shall remove all temporary piping that may have been in use during the operational testing and shall assist the Owner with the placement of the facility

into its fully operational mode. The Owner's operations and maintenance personnel will be responsible for operation of the facility or portion of the facility during this period of time. The facility or portion thereof shall be fully and continuously operational, accepting all normal flow called for in design and performing all functions as designed.

The Contractor shall be available, with all appropriate subcontractors and trades, at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being tested. This assistance shall be available, if needed, on a 24-hour basis. The Engineer will not issue a certificate of Substantial Completion until the end of the commissioning period (including training) and then only when all corrections required to assure a reliable and completely operational facility have been complete. The Contractor shall be responsible for all costs in excess of the Owner's normal expected costs of operations during the commissioning period. The Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials, required to keep the portion of the plant being commissioned operational.

The commissioning period will be considered completed when the facility has been continuously operated without major interruption, equipment failure, or system breakdown for the specified commissioning period. A major interruption, failure or breakdown shall be a condition or event that prevents the facility from continuously and adequately handling normal flow, cannot be repaired or corrected immediately by the Contractor, and is not caused by improper operation and maintenance of the facilities by the Owner. An interruption of the commissioning period under these circumstances will require a re-start of commissioning once required repairs and corrections are made by the Contractor. Should the commissioning period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, the commissioning shall be repeated until the specified continuous period has been accomplished without interruption.

Final O&M manuals for the facilities must be accepted and ready for turnover to the Owner before the start of commissioning.

C. TRAINING

During the phase of water testing of equipment, the Contractor shall make available experienced factory-trained representatives of the manufacturers

of all the various pieces of equipment, to train the Owner's personnel in the operation and maintenance thereof. The time required for this training shall be as covered in the specifications for the specific piece of equipment. The Contractor shall notify the Engineer of the time of the training at least 10 days prior to the start time of the training.

1.4 SUBMITTALS

A. STARTUP AND TESTING PLAN

Prior to receipt of any progress payments in excess of 60 percent of the Contractor's total bid for the work, the Contractor shall submit to the Engineer five copies of a startup and testing plan with details of the installed tests and inspection procedures he proposes to adopt for testing and startup of all equipment to be operated singly and together.

B. TRAINING OUTLINE

The Contractor shall submit five copies of a detailed outline of training activities to be performed by each manufacturer's representative 10 days prior to the start time of the training. This outline shall indicate how the manufacturer's representative is going to allocate the required specified number of training hours to fulfill these contractual obligations.

PART 2 PRODUCTS

2.1 INSTALLATION

Materials employed in the installation shall conform to the requirements of the Contract Documents and the recommendations of the equipment manufacturers.

2.2 TESTING

A. GAUGES, METERS, RECORDERS, AND MONITORS

Gauges, meters, recorders, and monitors shall be provided by the Contractor as required to supplement or augment the instrumentation system provided under this Contract to properly demonstrate that all equipment fully satisfies the requirements of the Specifications. All devices employed for the purpose of measuring the performance of the facility's equipment and systems shall be specifically selected to be consistent with the variables to be monitored. All instruments shall be recently calibrated, and the Contractor shall be prepared at all times to demonstrate, through recalibration, the accuracy of all instruments employed for testing purposes. Calibration procedures shall be in

accordance with applicable standards of ASTM, ISA, and IEEE. The adequacy of all gauges, meters, recorders and monitors shall be subject to review by the Engineer.

B. RECORDS

The Contractor shall provide sign-off forms for all installed and operational testing to be accomplished under this Contract. Sign-off forms shall be provided for each item of mechanical, electrical and instrumentation equipment provided or installed under this Contract and shall contain provisions for recording relevant performance data for original testing and not less than three retests. Separate sections shall be provided to record values for the preoperation checkout, as well as signatures of representatives of the equipment manufacturers, the Contractor, and the Engineer.

C. TEMPORARY TEST FACILITIES AND MODIFICATIONS

The Contractor shall provide and install all necessary temporary piping, valves, pumps, tanks, controls, and other facilities and modifications to enable the operational testing of the permanent facility components. Operational testing requiring the recirculation of water or process fluids within the facility shall be performed by the Contractor using temporary facilities, if needed, provided and installed by the Contractor. Temporary facilities shall be removed by the Contractor once the required testing is completed.

PART 3 EXECUTION

3.1 INSTALLATION

All equipment and apparatus used in testing shall be installed by specialists properly skilled in the trades and professions required to assure first-class workmanship. Where required by detailed Specifications, the Contractor shall cause the installation of specific equipment testing items to be accomplished under the supervision of factory-trained installation specialists furnished by the equipment manufacturers. The Contractor shall be prepared to document the skills and training of all workmen engaged in the installation of all testing equipment furnished either by the Contractor or the Owner.

3.2 TESTING

Testing shall proceed on a step-by-step basis in accordance with the Contractor's written testing procedures. The Contractor's testing work shall be accomplished by a skilled team of specialists under the direction of a coordinator whose sole

responsibility shall be the orderly, systematic testing of all equipment, systems, structures, and the complete facility as a unit. Each individual step in the procedures shall be witnessed by a representative of the Engineer.

During the facility operational testing period, all equipment and systems in operation shall be operated to the greatest extent practicable, at conditions, which represent the full range of operating parameters as defined by the Contract Documents.

3.3 TRAINING

Training of the Owner's personnel shall be done by experienced technical manufacturers' representatives. Training shall be provided during a scheduled, dedicated session and shall not be combined with other field services such as equipment testing, startup and check-out. When required by these specifications, the training sessions shall be video and audio-taped by the Contractor and the final DVD delivered to the Owner. These manufacturers' representatives shall follow the outline presented here:

GENERAL OUTLINE FOR MANUFACTURER PRESENTATIONS

A. FAMILIARIZATION

1. Overview explaining theory of operation.
2. Show catalog, parts lists, drawings, etc., in the shop drawings and O&M manuals. Clearly identify the model or identification number of the equipment for which training is being provided.
3. Check out the installation of the specific equipment items.
4. Demonstrate the unit and show that all parts of the Specifications are met.
5. Answer questions.

B. SAFETY

1. Point out safety references.
2. Discuss proper precautions around equipment.

C. OPERATION

1. Point out reference literature.

2. Explain all modes of operation (including emergency).
3. Check out Owner's personnel on proper use of the equipment. (Let them do it).

D. PREVENTIVE MAINTENANCE (PM)

1. Pass out PM list including:
 - a. Reference material.
 - b. Daily, weekly, monthly, quarterly, semi-annual, and annual jobs.
2. Show how to perform PM jobs.
3. Show Owner's personnel what to look for as indicators of equipment problems.

E. CORRECTIVE MAINTENANCE

1. List possible problems.
2. Discuss repairs - point out special problems.
3. Open up equipment and demonstrate procedures, where practical.

F. PARTS

1. Show how to use parts list and order parts.
2. Check over spare parts on hand. Make recommendations.

G. LOCAL REPRESENTATIVES

1. Where to order parts: Name, address, telephone, fax, e-mail.
2. Service problems:
 - a. Who to call.
 - b. How to get emergency help.

3.4 FACILITY OPERATIONAL TESTING

The systems described below shall be tested to demonstrate the performance of mechanical, electrical, instrumentation and control subsystems together as an integrated system. Where the testing described in this Section conflicts with the testing requirements specified for individual equipment, or the manufacturer's recommended testing procedure, those requirements and procedures shall prevail.

Unless otherwise noted, a time period of 5 days shall be allowed for each facility operational test. Unless otherwise noted, each portion of the facility being operationally tested must perform through its complete design range for a period of **5 consecutive 24-hour days**. Facility operational testing shall be sequenced in coordination with the work sequence specified in Section 01110. Temporary facilities necessary for operational testing are specified in Paragraph 2.2 of this Section and in Section 01500.

***** END OF SECTION *****

SECTION 01900

SALVAGE AND DEMOLITION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers the demolition of existing structures, piping, equipment, and sitework, and the salvage of existing materials and equipment as indicated on the Plans and as specified herein.

All areas and facilities of the existing facility, which are not to be removed, must remain in continuous operation during the work in accordance with Section 01510. Demolition and salvage work shall create a minimum of interference with the operation of the facility.

The Plans show the major items to be demolished and removed. In addition to these items, the Contractor shall remove any other incidental above-grade items which are not to be used in the completed project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01510	Maintenance of Treatment Facility

1.3 SALVAGE

Salvageable equipment and material shall be removed with care so as not to impair future uses and shall include all equipment and material so indicated on the Plans. Salvaged equipment and material not reused or rejected by the Owner shall be cleaned and protected from corrosion and weather and delivered by the Contractor to the Owner at a site designated by the Owner.

Reuse of salvageable equipment and material by the Contractor will not be permitted except where specifically indicated on the Plans and in the Specifications or where approved by the Engineer and Owner. Salvageable equipment and materials rejected in writing by the Owner shall become the property of the Contractor and shall be disposed of away from the site without additional cost to the Owner.

1.4 DEMOLITION

The Contractor shall be responsible for compliance with current City, County, State, and Federal codes and regulations related to demolition.

The Contractor shall notify all affected utilities and comply with their respective requirements for abandonment of such utilities including power, telephone, natural gas, water, sanitary sewer, and storm sewer utilities.

The Contractor shall maintain access for the Owner's employees during the demolition period and provide barricades, fences, etc., as required for job site safety.

Demolition of concrete, masonry, roofing, asphalt, and other materials shall be done so as to avoid damage to existing structures intended to remain. Demolition or cutting required to add to or modify existing structures shall be done in such a manner that the appearance and utility of the existing structure is not impaired and so that a neat transition from new to old material may occur.

All piping and appurtenances located less than 4 feet below finished grade shall be removed and hauled to an approved disposal site. All piping and appurtenances located four feet or more below finished grade may be abandoned in place, unless shown otherwise on the Plans, as long as Contractor fully seals all pipe and appurtenance openings with grout.

All waste materials from demolition or cutting shall become the property of the Contractor and shall be removed from the site and hauled to an approved waste disposal site, if declared surplus by the Owner. All materials and equipment, however, are property of the Owner unless declared surplus. Some equipment and materials scheduled for salvage and delivery to the Owner are noted on the Plans.

***** END OF SECTION *****

DIVISION 2

SITework

The Contractor shall call the Utility Location Request Center (One Call Center), for field location, not less than 2 nor more than 10 business days before the scheduled date for commencement of excavation that may affect underground utility facilities, unless otherwise agreed upon by the parties involved. A business day is defined as any day other than Saturday, Sunday, or a legal local, State, or Federal holiday. The telephone number for the One Call Center for this project is (800) 424-5555. If no one-number locator service is available, notice shall be provided individually to those owners known to or suspected of having underground facilities within the area of the proposed excavation.

The Contractor is alerted to the existence of Chapter 19.122 RCW, a law relating to underground utilities. Any cost to the Contractor incurred as a result of this law shall be at the Contractor's expense.

No excavation shall begin until all know facilities in the vicinity of the excavation area have been located and marked.

***** END OF SECTION *****

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the clearing, grubbing, and stripping of the proposed project areas in preparation of foundations, embankment construction, and pipeline installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
02305	Wet Weather Earthwork
02300	Earthwork
02370	Erosion Control

1.3 DEFINITIONS

“Clearing, grubbing, and stripping debris” as hereinafter used shall be considered as all material removed by the clearing, grubbing, and stripping operations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 DISPOSAL OF CLEARING AND GRUBBING DEBRIS

Clearing and grubbing debris shall be disposed of by hauling to waste and disposal sites approved by the Owner.

3.2 CLEARING AND GRUBBING

Clearing and grubbing shall be performed as required to complete the work shown on the Plans to a minimum depth of 8 inches in order to remove the root zone of existing vegetation.

This work shall include removal and disposal of all trees, logs, brush, stumps, roots, and minor manmade structures to include but not limited to concrete, asphalt abandoned metal and equipment, rubbish and debris to the limits indicated

on the plans or as required and approved by the owner. This work shall be to a depth necessary to remove stumps, large roots and all other objectionable material. This work shall also include the protection from injury or defacement of trees, bushes, shrubs, and other objects designated to remain.

***** END OF SECTION *****

SECTION 02240

DEWATERING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes dewatering excavations of any kind and location, including but not limited to groundwater, surface water, and precipitation, until backfilling has been completed to finished grade.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02370	Erosion Control

1.3 SUBMITTALS

Prior to the start of construction, the Contractor shall submit a dewatering plan in accordance with Section 01300 containing both a graphical and narrative presentation identifying proposed methods, equipment sizes and contingency plans should dewatering cause settlement of any adjacent facilities. The dewatering plan shall show specific locations, in plan and section, where dewatering is expected as well as a general discussion of methods to be employed should water be encountered in other locations. The plan shall detail the depth, diameter and anticipated flow for dewatering wells, well points or sumps.

Acceptance by the Owner of the method, installation, and operation and maintenance details submitted by the Contractor shall not in any way be considered to relieve the Contractor from full responsibility for errors therein or from the entire responsibility for complete and adequate design and performance of the system in controlling the water level in the excavated areas, and for control of the hydrostatic pressures to the depths specified herein. The Contractor shall be solely responsible for the proper design, installation, proper operation, maintenance, and any failure of any component of the dewatering system.

1.4 REFERENCES

“Rossum J.R., 1954, *Control of Sand in Water Systems*, Journal American Water Works Association, Volume 46, pp. 123-132”

1.5 QUALITY CONTROL

It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering efforts to avoid all objectionable settlement and subsidence. The Contractor shall comply with local codes and ordinances of governing authorities with regard to disposal of water pumped from dewatering operations.

Proposed discharge points shall be approved by the Owner prior to implementation of dewatering. The Contractor shall be responsible for taking all reasonable precautions necessary to ensure continuous, successful operation of the system.

PART 2 PRODUCTS

The Contractor shall have sufficient pumping equipment and/or other machinery available onsite before operations begin to assure that the operation of the dewatering system can be maintained. This shall include providing backup pumps of similar capacity and a standby generator of the capacity required to continuously operate the Contractor's dewatering system.

PART 3 EXECUTION

3.1 INSTALLATION AND APPLICATION

During excavation, the installation of piping, conduits and structures and during the placing of backfill, excavations shall be kept free of water, subsurface or otherwise. The Contractor shall furnish all equipment necessary to dewater the excavations and shall dispose of the water so as not to cause a nuisance or menace to the public. The dewatering system shall be installed and operated by the Contractor so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property. The release of groundwater to its static levels shall be performed so as to maintain the undisturbed state of the foundation soils, prevent disturbance of backfill and prevent movement of all structures and pipelines.

Design implementation and maintenance of any dewatering system shall be the responsibility of the Contractor.

The Contractor shall construct all dewatering wells in accordance with WAC 173-160. The dewatering system shall be sufficient to maintain the groundwater level at an elevation to protect the surface of the trench bottoms, the base of the bedding course or other foundation, and shall be accomplished prior to pipe laying and jointing or placement of reinforcing steel for concrete.

If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the excavations.

The Contractor shall design filters and screen slot sizes for all sumps, wells and well points which prevents the movement of fines during pumping. The Contractor shall develop the wells such that they produce no more than 10-ppm silica as measured with a Rossum Sand Tester (Rossum, 1954) or equivalent.

3.2 MONITORING

The Contractor shall install water level observation wells in dewatered areas sufficient to determine whether groundwater levels are maintained as per Part 3.1 of this Section.

3.3 FIELD QUALITY CONTROL

A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation. The Contractor shall test all dewatering discharge using a Rossum Sand Tester or equivalent to determine the silica content of the discharge. The Contractor shall notify the Owner at least 24 hours prior to testing. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement that could develop.

Should settlement be observed, the Contractor shall cease dewatering operations and implement contingency plans as outlined in the Contractor's approved dewatering plan. The responsibility for conducting the dewatering operation in a manner that protects adjacent structures and facilities rests solely on the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor. Permanent piping systems, existing or new, shall not be incorporated into the Contractor's dewatering system.

***** END OF SECTION *****

1.5 QUALITY ASSURANCE

A. SHORING CONSULTANT

The Contractor shall engage the services of a qualified geotechnical engineer and qualified structural engineer registered in the State of Washington to design temporary shoring and bracing when required by applicable regulations.

B. SHORING DESIGN

The Contractor shall provide layout and design drawings and specifications for shoring and bracing when a trench box is inadequate for the purpose or will not be used and trench depth exceeds 4 feet and back sloping will not be used. Temporary shoring and bracing system design and calculations shall be prepared, stamped, and signed by a Professional Engineer registered in the State of Washington.

C. REGULATIONS

The Contractor shall design sheeting, shoring and bracing in accordance with the Washington State Safety Code and any local codes and ordinances of governing authorities having jurisdiction.

1.6 SUBMITTALS

The Contractor shall submit shoring and bracing layout and design drawings, calculations and other backup data to the Owner for review in accordance with Section 01300 prior to the start of construction.

1.7 PROJECT CONDITIONS

A. SITE SURVEY

The background survey information provided on the Plans is shown for clarity only. The Contractor shall determine, before commencing work, the exact location of all existing features that may be disrupted by new construction, including existing underground utilities. The Contractor shall be fully responsible for any and all damages, which might be caused by the Contractor's failure to exactly locate and/or preserve existing site features. Prior to commencing work, the Contractor shall check and verify governing dimensions and elevations.

The Contractor shall survey adjacent structures and facilities, establishing exact elevations at fixed points to act as temporary bench marks to

monitor potential settlement from the contractor's ongoing operations. Clearly identify temporary bench marks and record existing elevations from the control points shown on the Plans.

During excavation, the Contractor shall resurvey bench marks weekly. The Contractor shall maintain and make available at the job site an accurate log of surveyed elevations for comparison with original elevations, and promptly notify the Owner if changes in elevations occur or if cracks, sags or other damage is evident.

1.8 EXISTING UTILITIES

The Contractor shall protect existing active sewer, water, gas, electrical, and other utility services and structures that may be present. This shall also include all pipelines, services, and structures that are the property of the Owner.

PART 2 PRODUCTS

The Contractor shall provide suitable shoring and bracing materials, which shall support loads imposed. Materials for shoring systems need not be new, but shall be in serviceable conditions.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

The Contractor shall notify the Owner immediately if, during construction, subsurface conditions are different from those encountered in the exploratory holes.

3.2 INSTALLATION AND APPLICATION

The Contractor shall provide shoring systems adequately anchored and braced to resist earth and hydrostatic pressures at locations as needed to support excavations during construction. The Contractor shall locate required bracing to clear all permanent work. Bracing which must be relocated shall be installed prior to the removal of original bracing. The Contractor shall not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to the Owner. The Contractor shall maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

SECTION 02275

GEOTEXTILE FABRIC

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes providing and installing a geotextile fabric to separate two dissimilar aggregate and/or soil materials.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02240	Dewatering
02250	Temporary Shoring and Bracing
02300	Earthwork
02305	Wet Weather Earthwork
02370	Erosion Control
02700	Gravel Materials

1.3 SUBMITTALS

The Contractor shall submit a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile in accordance with Section 01300. The Certification shall be attested to by a person having legal authority to bind the Manufacturer.

1.4 DELIVERY, STORAGE AND HANDLING

Geotextiles labeling, shipment, and storage shall follow ASTM D4873. Product labels shall clearly show the manufacturer or supplier name, style name, and roll number.

Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.

During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess

temperatures, and any other environmental conditions that may damage the physical property values of the geotextile.

PART 2 PRODUCTS

2.1 GEOTEXTILE FABRIC

The Geotextile fabric shall meet the requirements of section 9-33 of the WSDOT standard specifications.

Underground drainage fabric for drywells and other underground drainage shall be Moderate Survivability and at least Drainage Class C.

Geotextile for soil separation, soil stabilization or reinforced slopes and retaining walls shall be woven.

Permanent erosion control applications shall be High Survivability and Drainage Class C.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The geotextile shall be installed per Section 2-12 of the WSDOT Standard Specifications.

***** END OF SECTION *****

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the earthwork, including trench excavation and backfill for piping, excavation and backfill for structures, and finish grading.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01500	Temporary Facilities
02240	Dewatering
02250	Temporary Shoring and Bracing
02305	Wet Weather Earthwork
02370	Erosion Control
02700	Gravel Materials

PART 2 PRODUCTS

2.1 GRAVEL MATERIALS

All gravel materials shall conform to Section 02700.

PART 3 EXECUTION

3.1 PREPARATION

Excavation may commence once all erosion control measures are in place in accordance with the Plans and Section 02370 and to the satisfaction of the Owner.

3.2 GENERAL REQUIREMENTS

Excavation, compaction and backfill for structures, pipelines and the final site contours shall be formed by either excavating or compacting fill, as required, to provide the cross-sections as shown on the Plans.

All excavation performed on this Project shall be considered unclassified.
Excavation shall consist of the removal of any and all material encountered,

including debris, rubble, concrete, metal, topsoil, cutting and removal of existing surfacing, tree stumps, trees, logs, abandoned rail ties, abandoned piping, piling, riprap, etc.

Excavations shall be kept free of water, both surface water and groundwater, during the excavation, installation of pipelines and structures, and the placement of backfill. For additional requirements see Section 02240.

The Contractor's attention is also called to the depth of the structures and piping; for this reason, special shoring and bracing may be required. All shoring and bracing or sheeting required to perform and protect the excavation and to safeguard the employees, shall be furnished by the Contractor. For additional requirements see Section 02250.

No timber bracing, lagging, sheathing or other lumber shall be left in any excavation except with permission of the Engineer and in the event such permission is granted, no separate payment shall be allowed for burying such material.

All stockpiles shall be covered with plastic and no stockpile shall be higher than 6 feet above existing grade.

3.3 EXCAVATION AND BACKFILL FOR STRUCTURES

Excavation and backfill for structures shall be in conformance with Section 2-09 of the WSDOT Standard Specifications, and as further described herein. All excavation for structures shall be done to the dimensions and levels indicated on the Plans or specified herein. Excavation shall be made to such width outside the lines of the structures to be constructed as may be required for proper working methods, the erection of forms and the protection of the work.

Excavation shall consist of the removal of any and all material encountered to the elevations shown on the Plans. Excavations for structures shall be continued down to the subgrade which is defined as 12 inches below concrete mat foundations, concrete footings, and slab on grade floors for the installation of foundation gravel material such as crushed surfacing base course, unless otherwise noted on the Plans.

Fill material placed under structures, including footings and floor slabs, shall be crushed surfacing base course free from debris and organics, as specified in Section 02700.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of

unsuitable material is required by the Engineer, it will be under the unit price bid item entitled "UNSUITABLE EXCAVATION," as described in Section 01200. The Contractor shall then replace the material with compacted crushed surfacing base course, as specified in Section 02700. If imported crushed surfacing base course is required; it will be paid under the unit price bid item titled "CRUSHED SURFACING BASE COURSE," as specified in Section 01200. Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

The Contractor shall notify the Engineer when excavation for compacted fill or structures is complete. No forms, reinforcing steel, or concrete shall be placed until the excavation has been inspected by the Engineer.

Backfill for structures shall be Gravel Backfill for Walls as specified in Section 02700.

There is no warranty that the native material is suitable for backfill or is suitable, as excavated, for placement and compaction as required by these Specifications. In the event that the Contractor is unable to find onsite, sufficient native material to accomplish the structure backfilling, the select material that he shall furnish and install shall be Gravel Backfill for Walls, as specified in Section 02700.

3.4 PROTECTION OF FOUNDATION SURFACES

Care shall be taken to preserve the foundation surfaces shown on the Plans in an undisturbed condition. If the Contractor unnecessarily over excavates or disturbs the foundation surfaces shown on the Plans or specified herein without written authorization of the Engineer the Contractor shall replace such foundations with concrete fill or other suitable material approved by the Owner in a manner which will show by test an equal bearing capacity with the undisturbed foundation material. No additional payment shall be made for the added quantity of concrete fill or other suitable material used because of unnecessary over excavation caused by the Contractor or their operations.

3.5 EXCAVATION AND BACKFILL FOR TRENCHES

Excavation and backfill for trenches shall be in conformance with Sections 7-08 and 7-09 of the WSDOT Standard Specifications, and as further described herein. The following pipe materials shall be considered flexible:

- PVC

All other pipe materials shall be considered rigid.

Upon completion of work each day, all pipeline open trenches shall be completely backfilled, leveled, and temporarily patched or graveled, as herein specified. Under certain conditions, the trench may be left open at the last length of pipe laid during the day to avoid re-excavation the following morning, provided that the opening is adequately plated or covered for vehicle traffic. Special attention shall be given to barricading to keep vehicular traffic away from newly-backfilled trench areas until restored for traffic.

The Engineer reserves the right to restrict the Contractor in the amount of trench for pipeline that can be opened during the working day. Should the Contractor, in the Engineer's opinion, fail to diligently pursue backfilling, an allowable limit of open trench shall be 100 lineal feet and shall be strictly enforced.

The width of the trench at or below a point 12 inches above the top of the outside diameter of the pipe shall be carefully controlled and maintained to ensure the strength of the pipe and prevent pipe failures. Backfilling shall proceed as follows:

A. SUBGRADE PREPARATION

The subgrade for piping is defined as the elevation of the bottom of the pipe bedding material as shown on the Plans.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of unsuitable material is required by the Engineer, it will be paid for under the unit price bid item entitled "UNSUITABLE EXCAVATION," as found in the Proposal. The Contractor shall then replace the material with compacted crushed surfacing base course, as specified in Section 02700. Imported crushed surfacing base course is required, it will be paid under the unit price bid item titled "CRUSHED SURFACING BASE COURSE."

Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

B. BEDDING FOR RIGID PIPE

Above the foundation material, if any, the bedding material shall be Gravel Backfill for Pipe Bedding, as specified in Section 02700. This material shall be placed in lifts of approximately 8 inches up to a point 12 inches above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

C. **BEDDING FOR FLEXIBLE PIPE**

Above the foundation material, if any, Gravel Backfill for pipe bedding, as specified in Section 02700, shall be placed in lifts of approximately 8 inches up to a point 12 inches above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

D. **BACKFILL FOR TRENCHES**

Partial backfill to protect the pipe will be permitted immediately after the pipe has been properly laid in accordance with the Plans and these Specifications. Complete backfilling of trenches will not be permitted until the section of pipe installed has been inspected by the Engineer.

From the point 12 inches above the top of the pipe barrel, the backfill material to be used in the trench section shall Bank Run Gravel, as specified in Section 02700, except where required or shown on the Plans to use other material. The Contractor shall place backfill in horizontal lifts not to exceed 8 inches in thickness. All backfill shall be free of large rocks, organic matter, stumps, trees, pieces of pavement, broken concrete and other deleterious substances.

The Contractor shall remedy, at their expense, any defects that appear in the backfill prior to final acceptance of the work. Cleanup operations shall progress immediately behind backfilling to accommodate the return to normal use of the trench area.

During placement of the initial lifts, the backfill material shall not be bulldozed into the trench or dropped directly over the pipe with less than 3 feet of backfill material above the top of the pipe.

3.6 ROCK EXCAVATION

It is not anticipated that solid rock will be encountered. Should such material be encountered, however, it will be paid for change order as directed by the Engineer and approved by the Owner. Boulders or broken rock less than 2 cubic yards in volume as measured in the field by the Engineer, will not be classified as rock, nor will so-called "hard-pan" or cemented gravel, even though it may be advantageous to use explosives in its removal if blasting were allowed. For the purpose of this contract, rock excavation shall be defined as mineral matter in place and of such hardness and texture that, when it is encountered, cannot be loosened by three passes of a ripper tooth mounted on the larger of a tracked backhoe of at least 25,000 pounds operating weight and 75 horsepower or the largest backhoe being utilized on the job by the Contractor. Where rocks occur as boulders that are smaller than the larger of: (1) 2 cubic yards in volume, or (2) the

volume that can be readily handled by the largest backhoe being utilized on the job by the Contractor, they shall be considered incidental to excavation.

Where removal of a boulder results in a void below the desired elevation of the intended excavation, backfilling of the void shall be handled in the same manner as the replacement of unsuitable excavated material.

3.7 REUSE AND DISPOSAL OF EXCAVATED MATERIAL

Excavated materials shall be properly protected and reused where possible. Excavated materials not used for fill shall be hauled to an approved waste site(s), as selected by the Contractor. The Contractor shall submit a list of approved waste haul site(s) to the Owner prior to the commencement of hauling of waste materials. Any permits required for waste haul and disposal shall be the responsibility of the Contractor.

3.8 FINAL SITE GRADING

The site shall be graded consistent with the elevations shown on the Plans. The slopes between elevations shall be uniform or as shown on the Plans. Excavations and backfill shall be to the elevations required for the placement of all surface restorations, such as asphalt, concrete, gravel surfacing, or landscaping. All areas shall be graded to provide proper drainage. The final ground surface shall be smooth, raked free of debris and stones, and prepared for restoration as specified in Section 02900.

3.9 STRUCTURE COMPACTION

The foundation gravel material such as crushed surfacing base course placed underneath all structures shall be moisture conditioned to within 3 percent of optimum moisture content and shall be placed in loose, horizontal layers. The thickness of layers placed before compaction shall not exceed 8 inches for heavy equipment compactors and shall not exceed 4 inches for hand-operated mechanical compactors. Water settlement is not allowed for compaction.

Layers shall be compacted to a dense state equaling at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557. Prior to the placement of fill below structures, any and all groundwater and surface water shall be drained or pumped from areas to be filled.

Wall backfill material shall be compacted to at least 90 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557 within 5 feet of all walls and shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557 beyond 5 feet of all walls. Any

and all compaction within 5 feet of all walls shall be accomplished by means of hand-operated mechanical equipment rather than heavy equipment compactors.

3.10 TRENCH COMPACTION

Trench backfill materials shall be moisture conditions to within three percent of optimum moisture content. Water settlement is not allowed for compaction.

Pipe bedding materials, for both rigid and flexible pipes, shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

Compaction of the backfill above the bedding material in all trenches in non-structural and non-paved areas shall be performed by using mechanical equipment to at least 90 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

Compaction of the backfill above the bedding material in all trenches in structural or paved areas shall be performed by using mechanical equipment to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

***** END OF SECTION *****

SECTION 02305

WET WEATHER EARTHWORK

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the procedures to be followed if earthwork is to be accomplished in wet weather or in wet conditions where control of soil moisture is difficult.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02370	Erosion Control
02700	Gravel Materials

PART 2 PRODUCTS

The size or type of construction equipment shall be selected as required to prevent soil disturbance. In some instances, it may be necessary to limit equipment size or to excavate soils with a backhoe, Gradall, or equivalent type of equipment to minimize subgrade disturbance caused by construction traffic.

Material used as structural fill during wet weather earthwork shall generally consist of clean granular material containing less than 5 percent fines (material passing the U.S. Standard No. 200 sieve), based on wet sieving the fraction passing the 3/4-inch sieve. The fines shall be non-plastic.

PART 3 EXECUTION

3.1 WET WEATHER EXCAVATION AND FILL PLACEMENT QUALITY CONTROL

Excavation and placement of fill or backfill material will be observed on a full-time basis by the Owner, to determine that all work is being accomplished in accordance with these Specifications.

3.2 WET WEATHER EARTHWORK PROTECTION

The ground surface shall be sloped away from construction areas to promote the rapid runoff of precipitation and prevent ponding of water.

Earthwork shall be accomplished in small sections to minimize exposure to wet weather. Excavation or the removal of unsuitable soil shall be followed immediately by the placement and compaction of a suitable thickness (generally 8 inches or more if approved by the Owner) of clean crushed surfacing base course.

No soil shall be left uncompacted and exposed to moisture. A smooth drum vibratory roller, or equivalent, shall be used to seal the ground surface after placement of fill or backfill materials.

All wet weather work shall meet local, state and federal codes as specified herein and as indicated on the Plans.

***** END OF SECTION *****

SECTION 02370

EROSION CONTROL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary erosion and sedimentation control (TESC) in and around the site caused by the actions of the Contractor as shown on the Plans and as specified herein.

Work under this Section shall be directed towards site areas disturbed during construction as well as all off-site storage and parking areas maintained by the Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals
02240	Dewatering
02300	Earthwork

PART 2 PRODUCTS

2.1 SILT FENCES

Silt fences shall conform to the details shown on the Plans and the fabric shall conform meet the requirements of Geotextile for Temporary Silt Fence of Section 9-33 of the WSDOT Standard Specifications.

2.2 STORM DRAIN INLET (CATCH BASIN) PROTECTION

Storm drain inlet protection shall be with a "silt sack," as manufactured by ACF Environmental or equal.

2.3 EROSION CONTROL BLANKET

On all disturbed slopes steeper than 2H:1V, an erosion control blanket shall be placed and secured per manufacturer's recommendation with a biodegradable means.

The erosion control blanket shall be temporary, biodegradable and is to remain in place.

The erosion control blanket shall be “Biomac C” as manufactured by MacCafferri, Inc. or “Curlex II,” as manufactured by American Excelsior Co., or Equal.

PART 3 EXECUTION

3.1 PREPARATION

Site preparation work shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped.

3.2 BEST MANAGEMENT PRACTICES (BMPS)

Silt fences shall be constructed to control erosion and migration of soils disturbed during construction. The fences and dams shall provide temporary protection and shall be removed only upon approval of the Owner.

All areas or drainage ways downstream of the construction site shall have Best Management Practices (BMPs) installed prior to the beginning of any clearing activities. Runoff from cleared or disturbed area shall be directed through the BMPs. Disturbed ground shall be stabilized at the end of each work day. Permanent soil stabilization and erosion and sedimentation control shall be implemented upon reaching finish grade. Slope protection shall be immediately implemented upon any soils showing signs of erosion. This shall be done in a manner approved by the Owner.

All BMPs shall be inspected, maintained and kept in a condition sufficient to provide effective erosion and sedimentation control at all times. The site shall be inspected to ensure the BMPs are properly located, constructed and operating as designed during the first storm. Any necessary adjustments or repairs shall be made immediately and be approved by the Owner. The BMPs shall be inspected thereafter as noted on the Plans and after all significant storm events. Turbidity monitoring will be held on a weekly basis at a minimum, or more frequently if necessary as determined by the CESCL.

All BMPs shall be removed no later than 30 consecutive calendar days after final site stabilization has been achieved as determined by the Owner. BMPs such as storm drain inlet protection, straw bales, silt fences and supports and plastic coverings shall be removed and properly disposed of offsite by the Contractor. Areas disturbed by removal of these BMPs shall be immediately stabilized in a manner approved by the Owner.

***** END OF SECTION *****

SECTION 02510

DISINFECTION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes disinfection of potable water piping, distribution mains, filter basins, and structures; testing; and reporting results.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
Division 15	Mechanical

1.3 REFERENCES

- A. AWWA B300 - Standard for Hypochlorites.
- B. AWWA B301 - Standard for Liquid Chlorine.
- C. AWWA B302 - Standard for Ammonium Sulfate.
- D. AWWA B303 - Standard for Sodium Chlorite.
- E. AWWA C651 - Standards for Disinfecting Water Mains.

1.4 SUBMITTALS

A. TEST REPORTS

Indicate results comparative to specified requirements.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01300.
- B. **DISINFECTION REPORT; RECORD**
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.

3. Test locations.
4. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
5. Date and time of flushing start and completion.
6. Disinfectant residual after flushing in ppm for each outlet tested.

C. BACTERIOLOGICAL REPORT; RECORD

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certification that water conforms, or fails to conform, to bacterial standards of the Department of Health.
8. Bacteriologist's signature and authority.

1.6 QUALITY ASSURANCE

Perform Work in accordance with AWWA C651.

1.7 REGULATORY REQUIREMENTS

- A. Conform to Department of Health code or regulation for performing the work of this Section.
- B. Provide certificate of compliance from Department of Health indicating approval of water system.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that piping system has been cleaned, inspected, and pressure tested.
- B. Perform scheduling and disinfection activity prior to startup, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 WATER PIPE DISINFECTION

- A. Provide and attach required equipment to perform the work of this Section.
- B. Inject treatment disinfectant into piping system.
- C. Maintain disinfectant in system for 24 hours.
- D. Replace permanent system devices removed for disinfection.
- E. Water for disinfection must be obtained by the Contractor by arrangement with the Owner. The following describe specific procedures to be used by the Contractor in maintaining a satisfactory environment for prevention of contamination of the proposed water system installation, the cleanliness of the pipe and fittings and the actual method of disinfection.
- F. When the line is completed and ready to disinfect, water shall be allowed to flow in slowly, until it appears at the far end of the line so as not to displace the disinfecting agent. The system shall then be allowed to stand for at least 24 hours. The line shall then be flushed through the drain stations until a test shows no more than two parts per million of available chlorine.
- G. In all instances, the Contractor shall utilize a state approved double check valve type backflow prevention device to protect the potable water supply while filling, flushing and disinfecting the particular water main.

- H. Where connections are made to existing facilities and it is impractical to use the methods described herein to disinfect the section between the existing water main and the point of isolation of the new water main (valve or temporarily plugged line) or where pipes and fittings require immediate use, cleaning and disinfecting shall be directed by the Owner.
- I. The Contractor is herein advised that prior to making any restorations or permanent connections to the existing water mains, that the Contractor shall first demonstrate to the Owner, that the new water main has adequately passed a pressure test, been adequately flushed, and finally passed the required bacteriological test.
- J. In all disinfection processes, the Contractor shall take particular care in flushing and wasting the chlorinated water from the mains to assure that the flushed and chlorinated water does no physical or environmental damage to property, streams, storm sewers or any waterways. The Contractor shall chemically or otherwise treat the chlorinated water to prevent damage to the effected environment, particularly aquatic and fish life of receiving streams. The method and the time of flushing is to be approved by the Owner.
- K. Before placing the lines in service, satisfactory results must be obtained on samples collected from representative points in the new system and submitted to a State DOH approved laboratory. The Owner shall collect all samples for the bacteriological tests. However, the Contractor shall notify the Owner for collection of samples two days in advance, and schedule on days wherein samples can be conveniently processed by State DOH approved laboratory. If any of the pipeline materials are replaced thereafter, then that section shall again be disinfected and tested for bacteriological count.

If disinfection of mains by the above methods, prove unsatisfactory and the lab report indicates any type of bacteria count, then the Owner may direct the Contractor to use one of the following two disinfection methods until a satisfactory report is obtained. No additional compensation will be made to the Contractor for any work necessary to achieve a satisfactory bacteriological test result.

L. METHOD 1

A chlorine gas-water mixture, or dry chlorine gas may be applied by means of a chlorinator, or the gas may be fed indirectly from a chlorine cylinder equipped with the proper devices for regulating the flow, and the effective diffusion of gas within the pipe. (Use of the chlorinator is preferred to direct feed from the cylinder.)

1. Point of Application

The preferable point of application for the chlorinating agent is at the beginning of the pipeline extension, or any valved section thereof, and through a corporation cock inserted in the horizontal axis of the pipe may be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension.

2. Rate of Application

Water from the existing distribution system, or other source of supply, shall be controlled to flow very slowly into the newly laid pipeline during application of the chlorine. The rate chlorine gas-water mixture or dry gas feed shall be in such proportion to the rate of water entering the newly laid pipe that the dose applied to the water entering the newly laid pipe will be at least 50 parts per million. A color comparator set shall be used to determine chlorine residual.

3. Cross-Connection Prevention

A cross-connection control device (DOH approved) shall be utilized to prevent potential cross-connections.

4. Retention Period

Treated water shall be retained in the pipe at least 24 hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least 5 parts per million.

5. Chlorinating Valves and Hydrants

In the process of chlorinating newly laid water pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent.

6. Final Flushing and Chlorine Residual Test

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its length, upon test, shows the absence of chlorine (or in the event chlorine is normally used in the source of supply, then the tests shall show a residual not in excess

of that carried by the system). A state-approved bacteriological test shall then be conducted.

7. Repetition of Procedure

Should the initial treatment prove ineffective, the chlorination procedure shall be repeated until tests show that the water sample from the newly laid pipe conforms to the requirements of these Specifications.

M. METHOD 2

1. Calcium or Sodium Hypochlorite or Chlorinated Lime in Water

A mixture of either calcium or sodium hypochlorite or chlorinated lime of known chlorine content and water may be substituted as an alternative for liquid chlorine. (Typical commercial products of this type are Perchloron, Chlor, Purex, etc.)

2. Proportions of Chlorine Compound and Water Mixtures

Prepare a solution containing approximately 5 percent available chlorine by weight. In the case of Perchloron, at 70 percent available chlorine, use 6 pounds per 10 gallons of water. In the case of Chlor, at 15 percent available chlorine, add 2 parts water to 1 part of Chlor. For other strength compounds, adjust the dilution accordingly.

3. Preparation and Application of Chlorine Compound

To prepare the chlorine compound-mixture, first make a paste, and then thin to a slurry to ensure getting all active ingredients into solution. The prepared solution shall be injected by means of a hypochlorinator, or hand or engine operated pump. Pumping into the newly laid pipe shall follow the conditions outlined under Method 1 for chlorine applications to provide a residual of 50 ppm. See Item Nos. (a) to (3) inclusive under Method 1. For solutions containing approximately 5 percent available chlorine, the rate of bleeding the main to be sterilized should be 1,000 times the rate of feed or injection of the chlorine solution.

4. Further Procedure

Provisions for final flushing and bacteriological testing under this alternative should be the same as those described in Item (L) under Method 1 above.

3.3 RESERVOIR AND CLEARWELL DISINFECTION

Reservoirs and clearwell shall be disinfected in accordance with AWWA C652 (Disinfection of Water Storage Facilities).

Bacteriological sampling and testing shall be in complete compliance with AWWA C653-87 Section 5.3 and the requirements of the Washington State Department of Health.

3.4 QUALITY CONTROL

Samples shall be taken and tested in accordance with AWWA C651.

*****END OF SECTION*****

SECTION 02511

CONNECTION TO EXISTING SYSTEM

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the connection of pipelines being constructed under this project to existing water mains as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
Division 15	Mechanical

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

All cut-in connections to the existing system shall be made after a successful pressure test of the new main has been witnessed by the Owner and after a purity test has been satisfactorily evidenced except as allowed by the Owner.

The location, type and size of existing facilities have been determined from available records and are approximate. It is anticipated that connections to these existing facilities may be made, in general, as shown on the Plans except adjustments may be required for vertical and horizontal alignment.

It shall be the responsibility of the Contractor to determine the exact location and ascertain the type and size of the existing facilities prior to starting work on each connection and to provide any alternations as required in the connection detail.

Connections to existing facilities shall be made with the use of fittings, valves, flexible couplings, solid sleeves, shackling and other miscellaneous fittings, and thrust blocks as shown on the or with additional pipe or fittings as approved by the Owner and as indicated in Piping Systems to connect the new construction under this Project to the existing pipelines.

All pipe and fittings used for the connection shall be clean and disinfected with a minimum 5 percent chlorinated solution immediately prior to making said

SECTION 02530

UTILITY STRUCTURES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes precast concrete vaults, manholes, catch basins, castings, and steps for a complete installation as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork

PART 2 PRODUCTS

2.1 GENERAL

The exterior finish of all precast concrete utility structures shall be smooth with no imperfections larger than 1/8 inch in diameter. The interior finish of all precast concrete utility structures shall be smooth and sacked with non-shrink cementitious materials and epoxy bonding agent. No bug holes, fins, projections, or other defects are acceptable.

2.2 PRECAST CONCRETE CATCH BASINS

Precast components shall conform to the requirements of ASTM C478. All Portland cement used in the manufacture of the precast sections shall conform to the requirements of ASTM C150 and shall be Type II or Type V.

Thickness of a Type 1 catch basin shall be 4 inches minimum and reinforced with welded wire fabric having a minimum area of 0.12 square inches per foot. Welded wire fabric shall comply with ASTM A497. "Knockouts" shall be free of welded wire fabric and provided on four sides to accommodate the pipe size, invert elevations, and direction as shown on the Plans.

Standard precast riser sections shall consist of rectangular sections to accommodate a Type 1 catch basin. Reinforcement shall be in accordance with ASTM C497. Minimum height of a riser section shall be 6 inches. The height of

riser and base sections shall be arranged so no pipes pass through the joining surfaces.

Precast base sections for Type 2 catch basins shall conform to the requirements for precast riser sections. The base shall be a minimum of 6-inches thick underneath the pipe invert.

Standard precast riser sections shall consist of circular sections in standard nominal inside diameter as shown on the Plans. Reinforcement shall be in accordance with ASTM C478. Minimum height of a riser section shall be 1 foot. The height of riser and base sections shall be arranged so no pipes pass through the joining surfaces.

Openings for pipe shall be circular, tapered toward the inside of the section, and shall be of the minimum size possible to accommodate the size of pipe to be inserted and to effectively seal the joint.

2.3 FRAMES AND GRATES

A. MATERIALS

All Aluminum alloy extruded bars, rods, wire, shapes and tubes shall comply with ASTM B221, Alloy 6061-6.

B. PRODUCTS

Grating shall be serrated, aluminum alloy 6063, rectangular bar grating complying with the requirements of NAAMM "Metal Bar Grating Manual."

Unless noted otherwise on the Plans, minimum size of aluminum grating shall be 1-1/2" x 3/16" bearing bars at 1-3/16-inch on center with cross bars at 4-inches on center for a maximum span of 4'-6". For spans greater than 4'-6", grating shall be designed for 100 psf uniform load and 250 pounds concentrated load and 1/2-inch maximum deflection.

Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to the following:

AMICO Bar Grating
IKG Borden
McNichols Co.
Seidlehuber Metal Products

C. FABRICATION

Fabricate with bearing bars placed edgewise and joined by straight cross bars. Do not notch, slot or cut bearing bars to receive cross bars. Cross bars shall be secured to the main bearing bars to prevent turning, twisting, or coming loose. Each of the cross bars shall be trimmed flush with outside face of bearing bars. Grating shall be fully banded at ends and at all openings. Provide anchorage as indicated on the Drawings.

PART 3 EXECUTION

3.1 CATCH BASINS

Catch basin installation shall be as shown on the Plans. Precast sections with damaged joint surfaces or with cracks or damage that would permit infiltration shall not be installed.

Precast base sections shall be set on a prepared bedding material. Before the precast base is set, the gravel shall be carefully leveled to provide full bearing for the entire base slab.

The frame shall be set carefully to the established surface grade in a full bed of cement grout. The catch basin rim elevation shall be set flush with the pavement or improved areas.

3.2 FRAMES AND GRATE

All grating shall be mechanically fastened into place. Provide plate fasteners or F-9 fasteners as recommended by the manufacturer. Where removable grating is specified on the Plans, fasteners shall be provided and installed to allow for easy removal of the grating.

3.3 FINAL ADJUSTMENT AND CLEANUP

After installation is complete, the Contractor shall cleanout all precast structures prior to placing the new facilities into service. The adjustment of castings shall be done in a manner satisfactory to the Owner. Adjustment shall be done only with precast grade rings. Bricks are unacceptable. Grouting and final adjustment of castings shall be done with non-shrink grout.

***** END OF SECTION *****

SECTION 02700

GRAVEL MATERIALS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the various types of granular materials that are to be used in trenches and other excavations as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02305	Wet Weather Earthwork
02710	Gravel Surfacing

1.3 SUBMITTALS

The Contractor shall provide certificates of laboratory tests in accordance with Section 01300, indicating particle size distribution for review for each type of granular material furnished and proctor test reports for all material to be placed as pipe bedding material, trench backfill, backfill under and around structures and underneath crushed surfacing and asphalt concrete pavements.

The certificates and proctor test reports shall be provided to the Owner at least 5 calendar days prior to placement.

PART 2 PRODUCTS

2.1 GRAVEL BACKFILL FOR PIPE BEDDING

Gravel backfill for pipe bedding shall meet the requirements of Section 9-03.12(3) of the WSDOT Standard Specifications.

Native granular material shall not be utilized for gravel backfill for pipe bedding.

2.2 STRUCTURAL FILL

Structural fill shall consist of clean, non-plastic, free-draining sand and gravel free from organic matter or other deleterious materials, in conformance with Section 9-03.14(1) of the WSDOT Standard Specifications. The material shall contain particles less than 4-inches maximum dimension with less than 7-percent passing the U.S. No. 200 size sieve.

During period of wet weather the allowable fines content of the structural fill materials shall be no more than 5 percent passing the U.S. Standard No. 200 size sieve. Alternatively, crushed surfacing base course, in conformance with Section 9-03.9 (3) of the WSDOT Standard Specifications may be used.

2.3 BANK RUN GRAVEL FOR TRENCH BACKFILL

Bank run gravel for trench backfill shall be free from organic matter or other deleterious materials and in conformance with Section 9-03.19 of the WSDOT Standard Specifications.

2.4 QUARRY SPALLS

Quarry spalls shall conform to Section 9-13 of the WSDOT Standard Specifications. Materials used for quarry spalls shall meet the requirements of Section 9-13.1(5) of the WSDOT Standard Specifications, except that the size of material shall be revised as follows: 100 percent passing a 4-inch sieve size and 40 percent passing a 2-inch sieve size.

2.5 CRUSHED SURFACING

Crushed surfacing base course and top course shall conform to Section 9-03.9(3) of the WSDOT Standard Specifications.

2.6 PEA GRAVEL

Pea gravel shall be relatively round, processed, washed rock conforming to ASTM C33 with the following sieve analysis.

Sieve Analysis (% Passing by Weight)	
Sieve Size	Percent Passing
1/2"	100
3/8"	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

2.7 MISCELLANEOUS GRAVEL

If the Plans call for a gravel that is not herein specified than the gravel shall conform to the type of gravel called for as per the WSDOT Specifications.

PART 3 EXECUTION

3.1 CRUSHED SURFACING BASE COURSE

Crushed surfacing base course shall be placed and compacted underneath all structures to a minimum depth of 12 inches unless indicated otherwise on the Plans, and to a greater depth where foundations are unstable and excess suitable excavated material is unavailable to stabilize such foundations.

In the event the Contractor unnecessarily overexcavates the pipe trench or structure foundation, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.2 GRAVEL BACKFILL FOR PIPE BEDDING

Bedding material shall be placed simultaneously on both sides of the pipe for the full width of the trench in lifts not exceeding 6 inches. To assure uniform support, the material shall be carefully worked underneath the pipe haunches with a tool capable of preventing the formation of void spaces around the pipe. In the event the Contractor overexcavates the pipe trench, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.3 STRUCTURAL FILL

Provide structural fill as shown on the Plans or where excavated material is unsuitable as directed by the Engineer. Structural fill shall be installed in lifts not to exceed 8 to 10 inches maximum thickness. Structural fill placed under structures shall be compacted to at least 95 percent of the maximum dry density as determined by the modified Proctor, per ASTM D1557.

3.4 BANK RUN GRAVEL FOR TRENCH BACKFILL

Bank run gravel for trench backfill shall be used where excavated material is unsuitable or unavailable for the backfill of trenches as approved by the Owner.

In the event the Contractor overexcavates the pipe trench, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.5 QUARRY SPALLS

Quarry spalls shall be placed where shown on the Plans, where foundations are unsuitable if approved by the Owner or in other locations where approved by the Owner.

3.6 CRUSHED SURFACING

Crushed surfacing base course and/or top course shall be placed underneath asphalt paving, to the lines and grades shown on the Plans or as required by the Plans and shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

3.7 PEA GRAVEL

Pea gravel shall be placed underneath concrete slabs for buildings or structures where shown on the Plans. The minimum depth of pea gravel shall be 6 inches.

3.8 MISCELLANEOUS GRAVEL

Miscellaneous gravel shall be installed per the Plans.

***** END OF SECTION *****

SECTION 02710

GRAVEL SURFACING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation of crushed surfacing materials.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02700	Gravel Materials

1.3 SUBMITTALS

The Contractor shall provide the Owner with a certificate of laboratory test indicating gradation of each material provided in accordance with Section 01300. The certificate shall be provided to the Owner 5 calendar days prior to placement of any materials.

PART 2 PRODUCTS

2.1 GRAVEL MATERIALS

All gravel materials shall conform to the requirement of Section 02700.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be prepared as per Section 2-06.3 of the WSDOT Standard Specifications. As the rolling of the subgrade proceeds, all soft or spongy areas shall be removed and the resulting holes filled with ballast material or crushed surfacing base course as shown on the Plans. The Contractor shall dispose of excess materials resulting from the preparation of the subgrade. Rollers shall not be operated adjacent to structures where such use may cause damage. Where the subgrade abuts structures and compaction with a roller is not possible for practical reasons, the area shall be compacted with mechanical tampers or other approved equipment.

3.2 GRAVEL MATERIAL

Gravel materials shall be placed in the layers and thickness as shown on the Plans. Gravel materials shall be placed in accordance with Section 4-04.3 of the WSDOT Standard Specifications.

The Contractor shall place gravel materials in a uniform layer over the entire area to receive gravel materials without segregation of sizes, to such depth that when compacted with the power roller, the course shall have the required thickness. The maximum layer thickness for compaction with a roller shall be 6 inches for ballast or base course and 4 inches for crushed surfacing. The gravel material shall be bladed with a grader and rolled while damp with a power roller until the course is thoroughly and uniformly compacted and until its surface is smooth and conforms to grade and crown requirements shown on the Plans. The cross-section of the finished surface shall be subject to reasonable variations as approved by the Owner to meet the varying conditions encountered. The surface shall be maintained in its finished condition until the succeeding layer is placed.

The roller shall not be operated adjacent to structures where such use may cause damage. Where the gravel materials abuts structures and compaction with a roller is not possible for practical reasons, the area shall be compacted with mechanical tampers or other approved equipment.

3.3 COMPACTION

All materials shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

*****END OF SECTION*****

SECTION 02820

CHAIN LINK FENCE AND GATES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing and installing of chain link fencing and gates conforming to the lines, grades, and details and at the locations as shown on the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
03300	Cast-in-Place Concrete

PART 2 PRODUCTS

2.1 FENCING

Chain link fencing shall conform to Section 9-16 of the WSDOT Standard Specifications, and shall be a Type 3 fence per WSDOT Standard Plan, with the following exceptions. The fence shall have continuous chain link wire, tension wire and three strands of barbed wire supported on angled extension arms. The chain link shall have a 2-inch diamond mesh and 9-gauge wire, meeting ASTM 668, Class 2b. The chain link fence and all accessories shall be black vinyl coated. The total height of the fence shall be as shown on the Plans. The fence shall be heavy steel guard fence with top rail and bottom tension wire. Top and bottom selvages of chain link fabric are to have a twisted and barbed finish.

Rails, posts, and accessories shall be galvanized with 1.8 ounces per square foot and then powder coated with 3 mils of black TGIC polyester as applied by Powder Coat Northwest or equal.

The posts shall be equipped with extension arms, designed to carry three strands of barbed wire at an angle of 45 degrees. The topmost barbed wire shall be located approximately 12 inches above the fabric, and approximately 12 inches out from the fence line. Extension arms for line posts shall be of 14-gauge (minimum) pressed steel, provided with slots for securely fastening the barbed wires. Corner and fence post arms are to be of similar construction, and shall be constructed from a minimum of 12-gauge strip steel or heavy malleable iron, and shall be designed to provide sufficient strength to support the barbed wire.

The barbed wire shall be of the 4-point pattern, each wire to be composed of two strands of No. 12-1/2-gauge wire, galvanized after weaving.

2.2 GATES

Gates shall be installed for the full opening shown on the Plans as per the manufacturer's recommendations. The Contractor shall furnish padlocks and keys for gates, which comply with Owner standards. Gates shall conform to WSDOT Standard plan L-30, the Plans, and ASTM F900.

Gate posts shall be provided in accordance with ASTM F900 and have a ball top.

PART 3 EXECUTION

3.1 TEMPORARY FENCING

The Contractor shall furnish and install temporary fencing around the site so as to protect the site and prevent unauthorized entry into the site. The Contractor shall also maintain the temporary fencing throughout the course of the construction and provide any and all security necessary for site safety and protection during periods when sections of the fence may be down or open. Temporary fencing shall be removed by the Contractor only after receiving written authorization from the Owner for its removal.

3.2 FENCING INSTALLATION

The chain link fencing shall be erected in straight lines between angle points by skilled workmen experienced in this type of construction, in accordance with the manufacturer's recommendations and these Specifications. The new fence installation shall not commence until final grading is complete and finish grade elevations are established. The new fence shall be constructed to provide security for the site. There shall not be any gaps between finish elevations and the bottom links of the fence, which would allow entrance into the site.

The site fence shall be constructed in conformance with Section 8-12 of the WSDOT Standard Specifications. The maximum spacing for line posts shall be 10-feet on center. Post holes shall be a minimum depth of 3 feet below finished grade; holes for line posts shall be 10 inches in diameter; holes for gate, corner, and pull posts shall be four times the diameter of the post. Posts shall be set plumb in true line and to the depth of 3 feet and the remainder of the hole filled with concrete that must extend around the posts to a point 2 inches above finished grade. The top surface shall have a crowned watershed finish.

Concrete shall be proportioned to provide at least 2,500 psi strength at 28 days. Materials, methods of proportioning, mixing, transporting and placing shall conform to Section 03300. After the concrete has set, accessories shall be installed; chain link fabric shall be fastened to end posts with stretcher bars and clamps and to line posts and top rail with wire or bands at approximately 14-inch centers and 24-inch centers, respectively. Three lines of barbed wire shall be installed on the extension arms and drawn taut and secured at each bracket.

3.3 GATE INSTALLATION

Install gateposts in accordance with manufacturer's instructions.

Gate posts shall be diagonally braced to adjacent line posts to ensure stability. Gates shall be hung and all hardware adjusted so that gates operate satisfactorily from open or closed position.

Concrete set gateposts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter four times greater than outside dimension of post, and depths approximately 6-inches deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36 inches below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour, tamp for consolidation. Trowel finish around post and slope to direct water away from posts. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

Install gates plumb, level, and secure for full opening without interference.

Attach hardware by means which will prevent unauthorized removal. Adjust hardware for smooth operation.

*****END OF SECTION*****

SECTION 02950

SITE RESTORATION AND REHABILITATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes areas requiring restoration or rehabilitation as shown on the Plans or specified herein, including those areas that shall be graded, restored with hydroseeding or sod, areas restored with concrete sidewalk and driveway, and areas containing certain improvements and landscaping on and along the right-of-way including the adjacent private properties. The work also includes repair and replacement of fencing and other property features impacted construction.

Particular care shall be taken to minimize damage to landscaped areas within and adjacent to construction areas. In the event that construction is to be carried out in landscaped areas, appropriate measures shall be taken to restore such areas to conditions existing prior to construction.

Surface restoration type and location are shown on the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02230	Clearing and Grubbing
02300	Earthwork
02710	Gravel Surfacing
03300	Cast-In-Place Concrete

1.3 QUALITY ASSURANCE

A. PLANT MATERIAL

Quality, size, and conditions as determined by standards set forth in the American Association of Nurserymen Standard ANSI Z60.1.

B. FERTILIZER

Conform to Washington State Department of Agriculture Laws and Federal Specification O-F-241D pertaining to commercial fertilizers.

C. SEED

Conform to the standards for “certified”-grade seed or better.

Furnished in standard container on which the following information is shown: seed name, lot number, net weight, percentage of purity, germination, weed seed and inert material.

Furnish to the Owner duplicate copies of a statement signed by the vendor, certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before the date of delivery on the Project.

Seed that is wet, moldy, or otherwise damaged in transit or storage will not be accepted.

PART 2 PRODUCTS

2.1 HYDROSEEDING

The seed mixture for easement and property restoration shall have the following composition, proportion, and quality:

Alternative 1 Seed Mixture Typical Western Washington

Kind and Variety of Seed in Mixture	Percent By Weight	Minimum Percent of Pure Seed	Minimum Percent of Germination
Colonial Bent Grass (Highland or Astoria)	10%	9.8%	85%
Creeping Red Fescus (Illahee Rainier or Pennlawn)	40%	39.2%	90%
Perennial Rye Grass	30%	29.4%	90%
White Clover (Pre-inoculated)	20%	19.6%	90%
Maximum Percentage of Weed Seed	1.0%		
Maximum Inert and Other Crops	1.0%		

The seed mixture shall have the following composition, proportion and quality:

The seed shall be applied at a minimum rate of 120 pounds per acre.

A commercial fertilizer of the following formulation shall be furnished as specified, and all fertilizer shall be premixed prior to use on the job. The fertilizer shall be applied at the rate of 500 lbs. per acre.

Nitrogen (Inorganic) as N₂	Nitrogen (Organic) Ureaformaldehyde	Phosphorous as P₂O₅	as K₂O	Potassium lbs/Acre
10%	38%	20%	20%	500

The fertilizer shall contain a minimum of 60 percent slow-release nitrogen and all minor elements as well.

2.2 TOPSOIL

Topsoil shall have a pH value between 6 and 8, shall be fertile, friable, natural loam, containing 5 to 8 percent of humus, and shall be capable of sustaining vigorous lawn growth. Topsoil shall be free of any admixtures of subsoil, stones 2 inches in diameter or larger, clods of earth, plants or their roots, sticks, or other extraneous material. All topsoil shall be furnished as necessary and approved by the Owner to complete the required restoration and seeding.

2.3 CONCRETE

Concrete for concrete curb and gutter shall meet the requirements of Section 8-04 of the WSDOT Standard Specifications. Concrete for driveway entrances shall meet the requirement of Section 8-06 of the WSDOT Standard Specification. Concrete for sidewalks shall be the requirements of section 8-14 of the WSDOT standard Specification.

PART 3 EXECUTION

3.1 HYDROSEEDING

Areas that have been cleared and grubbed and graded within the public right-of-way, which are not covered by gravel, concrete, or pavement, shall receive hydroseeding, fertilizing, and mulching. These areas shall be leveled, acceptable to Owner, existing topsoil broken up to a depth of 6 inches and hydroseeded. Graded areas shall receive 6 inches of topsoil prior to hydroseeding. Native materials selected by the Owner from material excavated for foundations and stockpiled onsite may be used for topsoil.

For those areas in which hydroseeding would be difficult, the Contractor may request approval from the Owner to hand-apply the hydroseeding mix. Approval shall be granted for hand-application only after reviewing and approving the procedure that the Contractor recommends.

Seeding, fertilizing, and mulching shall be installed in conformance with Sections 8-01 and 9-14 of the WSDOT Standard Specification.

Seeding, fertilizing, and mulching shall be installed using an approved type hydroseeder.

When weather conditions are not conducive to satisfactory results from seeding operations, the Owner may order the work suspended and it shall be resumed only when the desired results are likely to be obtained.

Areas that have received an application of mulching shall be inspected upon completion of the work and again on the completion of the application of seed and fertilizer.

3.2 SOIL PREPARATION

Verify that planting bed grades are in accordance with those indicated on the Plans before proceeding with work. Verify that soil conditions are satisfactory for soil preparation work.

Prepare soil no closer than 3 feet from existing tree trunks up to 6 inches in diameter; no closer than 4 feet from existing tree trunks up to 12 inches in diameter; no closer than 6 feet from existing tree trunks larger than 12 inches in diameter.

Loosen compacted soils to a depth of 12 inches. Rake and remove all material larger than 1-1/2 inches in diameter.

Place 2 to 3 inches of topsoil over existing soil, mix and till to a depth of 6 inches. This material shall be suitable topsoil from the site or imported material.

3.3 TOPSOIL

Those areas to receive topsoil shall have the trenched backfilled to within 6 inches of the finished grade. A compacted 6-inch depth of topsoil shall then be applied to the subgrade. The Contractor may elect to utilize and stockpile existing and excavated topsoil material; however, no separate payment will be made for its use.

3.4 CONCRETE

Concrete Curbs and Gutters shall be constructed per WSDOT Standard Specifications section 8-04. Sidewalks shall be constructed per WSDOT Standard Specifications 8-14. Driveway entrances shall be constructed per WSDOT Standard Specification 8-06.

Any curb, gutter, sidewalk or driveway entrance damaged, defaced, cracked, chipped, or determined to be of poor workmanship, in the opinion of the Owner, shall be removed, wastehailed and replaced by the Contractor, at the Contractor's expense. Sacking and grinding shall not be considered an acceptable means for repairing unacceptable sections. The Contractor shall further provide verbal and

written notice (door hanger) to property owners identifying restricted use of their driveways, sidewalks, etc. This notice must be provided twice: at 1 week prior and again 1 day prior to the work being performed.

At locations where the new sidewalk is to abut existing concrete, saw concrete for a depth of 2 inches and chip the old concrete back to sound material on a straight line, clean the surface, and apply a neat cement paste just prior to pouring the new sidewalk.

Place preformed asphalt expansion joints in the adjacent curb, where the sidewalk ends at a curb, and around posts, poles, or other objects protruding through the sidewalk.

Provide contraction joints transversely to the walks at locations opposite the contraction joints in the curb. These joints shall be 3/16-inch by 1-inch weakened plane joints. They shall be straight and at right angles to the surface of the walk. Walk areas wider than 20 feet shall have longitudinal contraction joints at spacings not to exceed 15 feet.

Place, process, finish, and cure concrete in conformance with the applicable requirements of ACI 614 and this Specification. Where the requirements differ, the higher requirement shall govern.

Broom the surface with a fine-hair broom at right angles to the length of the walk and tool at all edges, joints, and markings. Mark the walks transversely at 5-foot intervals with a joining tool. Upon completion of the finishing, apply an approved curing compound to exposed surfaces. Protect the sidewalk from damage for a period of 7 days.

Driveway access shall be maintained at all times. The Contractor shall use steel plates to bridge entrances or construct entrances in sections in order to protect new driveway entrances and allow access during the curing period.

The driveway entrance, curb and gutter and sidewalk shall be protected against damage or defacement of any kind until acceptance by the Owner. Any driveway entrance not acceptable, in the opinion of the Engineer, because of damage or defacement shall be removed, wastehauled, and replaced by the Contractor at the Contractor's expense. Sacking, grinding, or spot repair shall not be considered an acceptable means for repairing unacceptable sections.

3.5 HYDROSEEDING, GRASS SOD, LANDSCAPING, WATERING MAINTENANCE AND PROTECTION

The Contractor shall water, protect and care for all seeded areas until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient watering of all planted areas until final acceptance.

Watering of hydroseeded, grass sod, and landscaped areas shall be at the Contractor's expense until new plantings are fully established.

The Contractor shall guarantee landscaping materials and workmanship for a period of 2 years following the date of project acceptance. During the 2-year guarantee period, should any planted areas show signs of failure, such as dead or dying areas of grass or bare spots, or any shrubs or trees planted as part of the site restoration fail, the Contractor shall repair or replace all deficient seeded areas and replace all dead shrubs and trees to the satisfaction of the Owner. If any seeded areas or plants require replacement, the Contractor's maintenance and guarantee period applicable to the replaced plants shall extend for an additional 1-year period after the time of the replacement.

The Contractor shall mow all newly established lawn areas a minimum of two mowings. The first mowing shall be performed only after an established and healthy stand of grass is judged to have grown. The second mowing shall occur upon establishment of second healthy stand of grass (4 inches in height).

3.6 FINISHING AND CLEANUP

Before acceptance of the Project, all pipes, manholes, catch basins, and other appurtenances shall be cleaned of all debris and foreign material. After all other work on the Project is completed and before final acceptance, the entire roadway, including the roadbed, planting, sidewalk areas, shoulders, driveways, alley and side street approaches, slopes, ditches, utility trenches, and construction areas shall be neatly finished to the lines, grades and cross-sections shown on the Drawings and as hereinafter specified.

In undeveloped areas, the entire area which has been disturbed by the construction shall be shaped so that, upon completion, the area will present a uniform appearance, blending into the contour of the adjacent properties. All other requirements outlined previously shall be met. Slopes, sidewalk areas, planting areas and roadway shall be smoothed and finished to the required cross-section and grade.

Upon completion of the cleaning and dressing, the Project shall appear uniform in all respects. All graded areas shall be true to line and grade as shown on the typical sections and as required by the Owner.

All rocks in excess of 1-inch diameter shall be removed from the entire construction area and shall be disposed of the same as required for other waste material. In no instance, shall the rock be thrown onto private property. Overhang on slopes shall be removed and slopes dressed neatly so as to present a uniform, well sloped surface.

All excess excavated material within the limits of the Project shall be removed entirely. All debris resulting from clearing and grubbing or grading operations shall be removed and disposed.

Drainage facilities, such as inlets, catch basins, culverts, and open ditches, shall be cleaned of all debris resulting from the Contractor's operations.

All pavements and oil mat surfaces, whether new or old, shall be thoroughly cleaned. Existing improvements, such as Portland cement concrete curbs, curb and gutters, walls, sidewalks, and other facilities which have been sprayed by the asphalt cement shall be cleaned to the satisfaction of the Owner.

Castings for manholes, monuments, water valves, lamp poles, vaults, and other similar installations which have been covered with the asphalt material shall be cleaned to the satisfaction of the Owner.

3.7 CONSTRUCTION ACCEPTANCE

The Contractor shall protect and care for all seeded and sodded areas until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient and continuous watering of all seeded areas until final acceptance.

The Contractor shall guarantee landscaping materials and workmanship for a period of 2 years following the date of project acceptance. During the 2-year guarantee period, should any seed areas show signs of failure such as dead or dying areas of grass or bare spots, the Contractor shall repair or replace all deficient areas to the satisfaction of the Owner.

3.8 ADJUSTMENT OF NEW AND EXISTING STRUCTURES TO GRADE

This work consists of constructing and/or adjusting all new and existing utility structures encountered on the Project to finished grade.

Prior to commencing manhole adjustments, a plywood and visqueen cover, as approved by the Owner, shall be placed over the manhole base and channel to protect them from debris.

The castings shall not be adjusted until the contractor has completed his paving operations. The asphalt concrete pavement around the casting shall be cut and removed to a neat circle, the diameter of which shall not exceed 6 inches from the outside diameter of the casting frame. The casting frame shall be brought up to the desired grade. Adjustment of manholes, catch basins and precast concrete vaults shall be made with the use of concrete adjustment rings or bricks. No iron adjustment rings will be allowed. An approved class of mortar (one part cement to two parts of plaster sand) shall be placed between adjustment rings or bricks and casting frame to completely fill all voids and to provide a watertight seal. No rough or uneven surfaces will be permitted inside or out. Adjustment rings or brick shall be placed and aligned so as to provide vertical sides and vertical alignment of ladder steps (if steps are necessary).

***** END OF SECTION *****

DIVISION 3

CONCRETE

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes reinforcement and associated items for all concrete, including, but not necessarily limited to: reinforcing steel bars, wire fabric, and accessories for cast-in-place concrete.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
03300	Cast-In-Place Concrete

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ACI 301	Structural Concrete for Buildings
ACI 318	Building Code Requirements for Structural Concrete
ACI SP-66	American Concrete Institute - Detailing Manual
ANSI/ASTM A82	Cold Drawn Steel Wire for Concrete Reinforcement
ANSI/ASTM A185	Welded Steel Wire Fabric for Concrete Reinforcement
ANSI/AWS D1.4	Structural Welding Code for Reinforcing Steel
ASTM A615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement

1.4 SUBMITTALS

Submit in accordance with provisions of Section 01300.

A. SHOP DRAWINGS

Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

B. MANUFACTURER'S CERTIFICATE

Certify that reinforcing bar and welded wire fabric meet or exceed specified requirements.

Submit certified copies of mill test reports of reinforcement materials analysis.

1.5 QUALITY ASSURANCE

Perform Work in accordance with ACI 301.

1.6 COORDINATION

Coordinate with placement of formwork, formed openings, and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. REINFORCING STEEL

ASTM A615, deformed bars: Grade 40 for #3 bars and smaller, Grade 60 for #4 bars and larger, unless noted otherwise on the Plans.

B. WELDED STEEL WIRE FABRIC

ASTM A185 Plain Type; in flat sheets; plain.

2.2 ACCESSORY MATERIALS

A. TIE WIRE

Minimum 16-gauge annealed type.

B. CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS

Sized and shaped for strength and support of reinforcement during concrete placement conditions including load-bearing pad on bottom where required to prevent vapor barrier puncture.

**C. SPECIAL CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS
ADJACENT TO WEATHER EXPOSED CONCRETE SURFACES**

Plastic-coated steel type; size and shape as required.

D. MECHANICAL BAR SPLICES

Comply with ACI 318 requirement of minimum tensile strength of 125 percent of specified yield for reinforcement.

Subject to compliance with the requirements and approval of the Engineer, products, which may be incorporated into the work include, but are not limited to, the following:

BAR-LOCK (MBT) Coupler Systems
“ERICO” REBAR SPLICING

E. ADHESIVE ANCHORS

Injection adhesive system shall consist of a dual-cylinder adhesive refill pack, a mixing nozzle, and dispenser. The adhesive shall be formulated to include resin and hardeners.

1. Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.
 - b. SET-XP, Simpson Strong Tie, Inc.
 - c. PE1000+, Powers Fasteners, Inc.

2.3 FABRICATION

Fabricate concrete reinforcing in accordance with ACI SP-66. Obtain written approval from the Engineer prior to welding reinforcing steel. Weld reinforcement in accordance with ANSI/AWS D1.4.

PART 3 EXECUTION

3.1 PLACEMENT

Comply with Concrete Reinforcing Steel Institute’s recommended practice for “Placing Reinforcing Bars” for details and methods of reinforcement placement and supports, and as herein specified. Avoiding cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete. Accurately position, support, and

secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal/plastic chairs, runners, bolsters, spacers, and hangers, as required.

Install reinforcing bars with clearance indicated on the Plans. Provide laps as shown and stagger locations to minimize the concentration of multiple reinforcing at joints. Bar lap splicing shall have full contact. Where full contact cannot be achieved, the maximum space between the spliced bars shall not exceed 2 inches. Unless noted otherwise on the Plans, provide two #5 minimum trim bars around all openings and penetrations. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with tie wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

***** END OF SECTION *****

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes schedules, notes, and details for the construction of cast-in-place concrete structures, landings, equipment piers, housekeeping pads and slabs on grade.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01400	Quality Control
03200	Concrete Reinforcement
Division 7	Thermal and Moisture Protection

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ACI 117	Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 212.3	Chemical Admixtures for Concrete
ACI 301	Specifications for Structural Concrete
ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305	Hot Weather Concreting
ACI 306	Cold Weather Concreting
ACI 309	Guide for Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete and Commentary
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ACI 347	Guide to Formwork for Concrete
ACI 350.1	Tightness Testing of Reinforced Engineering Concrete Structures and Commentary
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens

ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Ready-Mixed Concrete
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C172	Sampling Freshly Mixed Concrete
ASTM C173	Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C535	Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete

1.4 SUBMITTALS

Submittals shall be in accordance with Section 01300.

A. GENERAL

The submittal for each included concrete mix shall include, as a complete package, the following as defined below:

1. Concrete Mix Design
2. Certified Test Results
3. Sieve Analysis
4. Product Data

An incomplete concrete mix submittal package may render a rejection of the mix or could delay the review process.

B. CONCRETE MIX DESIGN

Submit mix design for the proposed mix to be used on the Project, indicating components, and proportions by weight, including any admixtures. Mix design shall state chloride content. Mix designs to be provided are:

1. Unspecified Concrete
2. Lean Concrete
3. Cement Grout

C. CERTIFIED TEST RESULTS

Submit laboratory test results indicating compressive strength of concrete in compliance with requirements specified herein and in accordance with ACI 301.

D. SIEVE ANALYSIS

Submit sieve analysis for proposed coarse and fine aggregates indicating components, source, gradation, and WSDOT aggregate source approval report, including WSDOT Aggregate Source ID.

E. PRODUCT DATA

Provide product data on all proposed admixtures, accessories, and embedded items to be used on the Project, including, but not limited to:

1. Cement; source and type
2. Air Entraining Agent
3. Water Reducing Admixtures
4. Pozzolans
5. Bonding Agents
6. Curing Compounds/Floor Hardeners
7. Non-Shrink Grout; Non-metallic and Metallic
8. Waterstops

9. Plastic Joint Formers

For admixtures other than those proposed for air entrainment, submit a letter from the manufacturer describing the benefits of its use for the project and effect of its use on the properties of the concrete. Product data shall expressly state admixtures are chloride free, or the manufacturer shall submit a letter certification stating the same.

F. MATERIAL DELIVERY TICKETS

Provide copies of all concrete and grout material delivery tickets for the Project to the Engineer.

1.5 QUALITY ASSURANCE

Perform work in accordance with ACI 301. Acquire cement and aggregates from same source for all work performed on the Project. Conform to ACI 305 when concreting during hot weather. Conform to ACI 306 when concreting during cold weather. Provide or coordinate field and laboratory testing as described later in this Section and under provisions of Section 01400.

1.6 COORDINATION

Coordinate work in accordance with provisions of Section 01310. Coordinate the placement of embedded items with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. FORMS FOR EXPOSED FINISH CONCRETE

Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on the Plans.

B. FORMS FOR UNEXPOSED FINISH CONCRETE

Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. FORMS FOR CYLINDRICAL COLUMNS AND SUPPORTS

Metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

D. FORM COATINGS

Provide commercial formulation form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

E. FORM TIES

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units, which will leave no metal closer than 1-1/2 inches to surface. Unless noted otherwise on Plans, provide ties with plastic cone devices which, when removed, will leave holes not larger than 1-inch diameter in concrete surface.

2.2 CONCRETE MATERIALS

A. CEMENT

ASTM C150, Type II – Moderate or Type I - II. Use one brand of cement throughout the project, unless otherwise approved by the Engineer. Provide low alkali cement where Alkali-Silica Reaction (ASR) mitigation measures are required by WSDOT Aggregate Source Approval.

B. FINE AND COARSE AGGREGATES

Comply with ASTM C33. Provide aggregates from a single source. Coarse aggregate shall be size designation 467 (Nominal size 1-1/2 inch to No. 4 sieve) for all liquid containing structures, and size designation 67 (Nominal size 3/4-inch to No. 4 sieve) for all other concrete. Aggregates shall show a loss of weight not exceeding 35 percent after 500 revolutions in a Los Angeles wear machine, when tested in accordance with ASTM C131 or ASTM C535. Aggregates shall be from a WSDOT approved source.

C. WATER

Clean, potable, and not detrimental to concrete, in compliance with ASTM C94.

2.3 ADMIXTURES

Except for air entrainment, use of all other admixtures used shall be subject to approval of the Engineer and at no additional cost to the Owner. Only admixtures expressly stated by the manufacturer as being chloride-free shall be used. Subject to compliance with requirements, products, which may be incorporated into the work include, but are not limited to, the following:

A. AIR ENTRAINMENT

ASTM C260 certified by manufacturer to be compatible with other proposed admixtures.

Master Builders MB AE 90 or MICRO-AIR
Sika AER
W.R. Grace Daravair or Darex Series

B. WATER REDUCING ADMIXTURE

ASTM C494 Type A.

Master Builders PolyHeed
Sika Plastocrete 161
W.R. Grace WRDA Series

C. ACCELERATING ADMIXTURE

ASTM C494 Type C.

Master Builders Pozzolith NC534
Sika Plastocrete 161 FL
W.R. Grace Polarset or DCI

D. WATER REDUCING, RETARDING ADMIXTURE

ASTM C494, Type D.

Master Builders Pozzolith 100XR
Sika Plastiment
W.R. Grace Daratard Series

E. WATER REDUCING, ACCELERATING ADMIXTURE

ASTM C494, Type E.

Euclid Chemical Co. Accelguard 80
Master Builders Pozzutec 20
W.R. Grace Daracel

F. HIGH RANGE WATER REDUCER (HRWR)

ASTM C494, Type F.

Master Builders Rheobuild 1000/3000 FC
Sika Sikament 10 ESL
W.R. Grace ADVA 100

G. HIGH RANGE WATER REDUCER AND RETARDER

ASTM C494, Type G.

Master Builders Pozzolith 440N
W.R. Grace Daracem-100

H. POZZOLAN

ASTM C618 - CLASS F, with a CaO maximum content of 10 percent.

2.4 ACCESSORIES

A. BONDING AGENT

ASTM C881, Type I and II, Grade 2, Class C, Epoxy Resin. Subject to Contract requirements, provide one of the following or equal:

Sika Armatec 110
Conspec SpecBond 100
W.R. Meadows Sealtight Rezi Weld 1000

B. CURING COMPOUND/CHEMICAL FLOOR HARDENER

ASTM C309, Type I, Class A and B. Subject to Contract requirements, provide one of the following or equal:

W.R. Meadows Sealtight 1100-Clear

Conspec RX cure
Chemrex, Inc. Masterkure
Burke Spartan-Cote WB

C. GENERAL PURPOSE NON-SHRINK NON-METALLIC GROUT

Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi (17 Mpa) in 48 hours and 7,000 psi (48 Mpa) in 28 days. Subject to Contract requirements, provide one of the following or equal:

Sika SikaGrout 212
Conspec 100 Non Metallic
Chemrex, Inc. Masterflow 928 Grout
W.R. Meadows Sealtight 588

D. WATERSTOPS

Provide waterstop of type and size at construction joints and other joints as indicated on the Plans.

1. PVC (Polyvinyl Chloride)

Serrated (ribbed), 3/8 of an inch minimum thickness for 6 inches and larger and 3/16 of an inch minimum thickness for 4 inches. Comply with Corps of Engineers CRD-C-572. No reclaimed PVC will be allowed in waterstop.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak
Vinylex Corporation
W.R. Meadows

2. Cold Joint Waterstop

Install where shown on the Plans or at locations approved by the Engineer. Cold joint waterstop shall be certified by the manufacturer to be compatible for use in wastewater (sewage) containment structures. Unless otherwise shown in the Plans, size shall be 1-inch thick and 1-inch wide.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Hydrotite, Greenstreak

E. PLASTIC JOINT FORMER

Provide and install, per manufacturer's recommendations, where shown on the Plans or at locations approved by the Engineer. Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak
Vinylex Corporation
W.R. Meadows

2.5 CONCRETE MIX

A. GENERAL

Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to the Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as that used for field quality control testing.

The maximum water soluble chloride ion content, expressed as a percent of the cement, contributed from all ingredients of the concrete mix, including water, aggregates, cementitious materials, and admixtures, shall not exceed 0.10 percent. Pozzolans may be counted as part of the total cementitious material in the concrete mix design. The cementitious material is the "minimum cement content" specified in the mix design for each type of concrete. When pozzolans are used as part of this "cement content," the minimum content shall be 15 percent by weight of the total cementitious materials (Portland cement and pozzolans) and not more than 20 percent.

Where ASR mitigation measures are required by WSDOT, provide a minimum of 15 percent pozzolan included in the cementitious material in the design mix.

B. MIX DESIGNS

Provide normal weight concrete with the following properties, unless noted otherwise on the Plans.

1. Unspecified Concrete

Structural concrete of general use in structures, sidewalks, and where no specific class of concrete is designated.

Minimum compressive strength @ 28 days: 3,500 psi
Minimum cement content: 5.5 sacks per cubic yard
Maximum water cement ratio by weight: 0.45
Nominal coarse aggregate size: 3/4" to No. 4 (size designation 67)

2. Lean Concrete

Concrete for pipe thrust blocks or for use as noted as "Concrete Fill" on the Plans.

Minimum compressive strength @ 28 days: 2,500 psi
Minimum cement content: 5 sacks per cubic yard

3. Cement Grout

Material for filling guard posts, grouting of clarifier bottoms or for other uses as shown on the Plans. Cement grout shall be sand and cement only and shall not contain coarse aggregate.

Minimum compressive strength @ 28 days: 2,500 psi
Minimum cement content: 6.5 sacks per cubic yard
Maximum water cement ratio by weight: 0.54

C. ADMIXTURES

1. Air Entrainment

Use air-entraining admixture complying with ASTM C260 in all exterior exposed concrete. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement in accordance with ASTM C173 or C231 having total air content with a tolerance of plus or minus 1 percent within the following limits:

5.5 percent for 1.5 inch max. coarse aggregate size

6.0 percent for 1.0 inch max. coarse aggregate size
7.0 percent 0.50 inch or less max. coarse aggregate size

2. Other Admixtures

Use of all other admixtures shall be subject to the approval of the Engineer, and shall be in accordance with ACI 212.3 and Manufacturer's recommendations. Only admixtures stated by the manufacturer to be chloride free shall be used.

D. SLUMP LIMITS

Proportion and design mixes to result in concrete slump (1 inch \pm of the maximum) at the point of placement in accordance with ASTM C143 as follows:

Ramps, slabs, and sloping surfaces: 3 inches.

Reinforced foundation systems: 3 inches.

Other concrete: 4 inches.

Concrete containing HRWR admixture (super-plasticizer): Not more than 8 inches after addition of HRWR to site-verified 2- to 3-inch slump concrete.

E. CONCRETE MIXING

Comply with requirements of ASTM C94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than that specified in ASTM C94 may be required.

PART 3 EXECUTION

3.1 GENERAL

Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

3.2 FORMS

Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be

supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the work. Use selected materials to obtain required finishes. Solidly butt joints and provide back up at all joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast-in-place concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Provide Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

Chamfer all exposed corners and edges and other areas shown on the Plans, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

3.3 JOINTS AND WATERSTOPS

A. CONSTRUCTION JOINTS

Locate and install construction joints where indicated, or locate so as not to impair strength and appearance of the structure, as acceptable to the Engineer. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise shown on the Plans.

B. WATERSTOPS

Provide waterstops in construction joints of all water containment structures and where shown on the Plans. Install waterstops to form continuous diaphragm in each joint in accordance with manufacturer's recommendations. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions and recommendations. All waterstops shall be tied into place using hog rings and/or tie wire to keep the waterstop from moving during placement of concrete. Provide manufacturer's written warranty for all waterstop installations.

C. ISOLATION JOINTS IN SLABS-ON-GRADE

Unless otherwise noted, construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as shown on the Plans.

Joint filler and sealant materials are specified in Division 7.

D. SLAB (CONTROL) JOINTS

Construct joints in slabs-on-grade as shown on the Plans. Use saw cuts 1/8 of an inch wide x 1/4 of the slab depth or inserts 1/4-inch wide x 1/4 of the slab depth.

E. PREMOLDED (CONTROL) JOINTS

Insert premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

F. EDGE FORMS AND SCREED STRIPS FOR SLABS

Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.4 INSTALLATION OF EMBEDDED ITEMS:

A. GENERAL

Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use installation drawings, diagrams, instructions, and directions provided by suppliers of items to be embedded.

B. CLEANING AND TIGHTENING

Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

C. REGLETS

Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashing as shown at lintels, relieving angles, and other conditions.

3.5 PLACING REINFORCEMENT

See Section 03200.

3.6 PREPARATION OF FORM SURFACES

Clean reused forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.7 PREPARATION OF EXISTING CONCRETE SURFACES

The Contractor shall bush hammer all existing concrete surfaces that are to have new concrete cast against them. Apply epoxy bonding agent prior to placing concrete.

3.8 CONCRETE PLACEMENT

A. GENERAL

Comply with ACI 304 and as herein specified.

Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during concrete placement.

B. PLACING CONCRETE IN FORMS

Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

C. PLACING CONCRETE SLABS

Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded

items and into corners. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Maintain reinforcing in proper position during concrete placement operations.

D. COLD WEATHER PLACING

Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27 degrees C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

E. HOT WEATHER PLACING

When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is at Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed. Upon approval, water-reducing retarding admixture (Type D) may be used when required by high temperatures, low humidity, or other adverse placing conditions.

3.9 FINISH OF FORMED SURFACES

Provide smooth form finish for all formed concrete surfaces exposed-to-view including all surfaces exposed to water or wastewater, or that are to be covered with a coating material applied directly to the concrete, or a covering material applied directly to concrete, such as veneer plaster, painting, or other similar type of system.

Provide smooth form finish for surfaces to be waterproofed or dampproofed. Surfaces must comply with recommendations of the manufacturer of the product being utilized.

Provide rough form finish for formed concrete surfaces not exposed-to-view in the finished work or by other construction, unless otherwise indicated.

A. SMOOTH FORM FINISH

This is to be the as-cast concrete surface obtained utilizing selected form facing material, arranged orderly and symmetrically with a minimum of seams, and as specified herein.

Repair and patch tie holes and defective areas, with all fins or other projections completely removed and smoothed, by one of the following methods:

1. Provide smooth rubbed finish to concrete surfaces after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
2. Provide grout "sacked" cleaned finish. The sacking grout shall be one part Portland cement to 1-1/2 parts fine sand by volume, and mixed with water to consistency of thick paint. Proprietary additives such as epoxy bonding agents or adhesives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts to be determined by trial patches, so that final color of dry grout matches adjacent surfaces. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep sacked surfaces damp by fog spray or other acceptable method so surfaces do not dry out.

B. ROUGH FORM FINISH

This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/8 of an inch in height rubbed down or chipped off. All “bug holes” exceeding 1/2 inch in diameter and exceeding 1/4-inch depth shall be repaired or filled in.

C. RELATED UNFORMED SURFACES

At tops of walls, horizontal offsets, and similar unformed surfaces occurring at adjacent formed surfaces, continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

D. TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:

- | | | |
|----|--|---|
| a. | In the lines and surfaces of columns, pier, walls and in arises | In any 10 feet of length – 1/4 inch. Maximum for entire length – 1 inch |
| b. | For exposed corner columns, control-joint grooves, and other conspicuous lines | In any 20 feet of length – 1/4 inch. Maximum for entire length – 1/2 inch |

2. Variations from level or from the grades indicated on the Plans:

- | | | |
|----|--|--|
| a. | In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores | In any 10 feet of length – 1/4 inch. In any bay or opening, or in any 20 feet of length – 3/8 of an inch. Maximum for entire length – 3/4 inch |
| b. | In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines | In any bay or opening, or in any 20 feet of length – 1/4 inch. Maximum for entire length – 1/2 inch |

- | | | |
|----|---|--|
| 3. | Variations in the linear building lines from the established position in plan view | In 20 feet of length – 1/2 inch.
Maximum for entire length – 1 inch |
| 4. | Variations in distance between walls, columns and partitions | In any 10 feet of distance – 1/4 inch. In any bay or opening – 1/2 inch. Maximum total variation – 1-inch. |
| 5. | Variations in the sizes and locations of sleeves, floor openings and wall openings | Minus – 1/4 inch
Plus – 1/2 inch |
| 6. | Variations in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls | Minus – 1/4 inch
Plus – 1/2 inch |
| 7. | Variations in footings: | |
| | a. Variation from dimensions on Plans when formed or plus 3-inches when placed against unformed excavations | Minus – 1/2 inch
Plus – 2 inches |
| | b. Misplacement of eccentricity | 2 percent of the footing width in the direction of the misplacement, but not more than 2 inches |
| | c. Reduction in thickness of specified thickness | Minus – 5 percent |
| 8. | Variations in steps: | |
| | a. In a flight of stairs | Riser – 1/8 of an inch
Tread – 1/4 inch |
| | b. In consecutive steps | Riser – 1/16 of an inch
Tread – 1/8 of an inch |

3.10 MONOLITHIC SLAB FINISHES:

A. SCRATCH FINISH

Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping, including grout finishes where indicated on plans, or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated. Slope surfaces uniformly to floor drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

B. FLOAT FINISH

Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. TROWEL FINISH

Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks and uniform in texture and appearance. Grind smooth surface defects that would telegraph up through applied floor covering system.

D. TROWEL AND FINE BROOM FINISH

Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

E. NON-SLIP BROOM FINISH

Apply non-slip broom finish to exterior concrete platforms, landings, steps, and ramps, sidewalks and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Owner before application.

F. CHEMICAL-HARDENER FINISH

Apply chemical-hardener finish to interior exposed concrete floors and steps, unless noted otherwise. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Evenly apply each coat, and allow 24 hours for drying between coats. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

G. TOLERANCES FOR MONOLITHIC SLAB FINISHES

The flatness of the concrete shall be carefully controlled and the tolerances shall be measured by the straight edge system as specified in paragraph 4.5.7 of ACI 117, using a 10-foot straight edge, within 72 hours after floor slab installation and before shores and/or forms are removed. The tolerances listed below shall be met at any and every location at which the straight edge can be placed.

Bullfloated	1/2 inch
Float Finish	3/16 inch
Trowel Finish	1/8 inch
Straightedges	5/16 inch

3.11 CONCRETE CURING AND PROTECTION

A. GENERAL

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep concrete continuously wet for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried out. Continue final curing for at least 7 days in accordance with ACI 301 curing methods. Avoid rapid drying of concrete at the end of final curing period.

B. CURING METHODS

Perform curing of concrete by use of curing and sealing compound, by moist curing, by moisture-retaining cover curing, or by combinations thereof, as herein specified.

Provide moisture curing by the following methods. Keep concrete surface continuously wet by covering with water, or provide continuous water-fog spray.

Covering concrete surface with absorptive cover, thoroughly saturating cover with water and keeping continuously thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in wide as practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walls, sidewalks, and curbs, as follows:

Apply curing and sealing compound to concrete slabs and walls as soon as initial curing operations are complete or immediately after the forms have been stripped (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Completely cover the concrete surfaces with curing and sealing compound. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair any damage during curing period.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.

C. CURING FORMED SURFACES

Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for

full curing period and until forms are removed. When forms are removed, continue curing by methods specified above, as applicable.

D. CURING UNFORMED SURFACES

Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of an appropriate curing method.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture retaining cover.

3.12 SHORES AND SUPPORTS

A. GENERAL

Comply with ACI 347 for shoring, and as herein specified. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until all concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

B. REMOVAL OF FORMS

Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Formwork supporting weight of concrete, such as beam soffits, joints, suspended slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained 70 percent of the design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens, representative of concrete location or members.

Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.13 REUSE OF FORMS

Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Provide new form facing material. Apply new form coating compound as specified for new formwork prior to reuse of forms.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, unless approved by the Engineer and acceptable to the Owner.

3.14 MISCELLANEOUS CONCRETE ITEMS

A. FILLING-IN

Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work. Fill-in all form tie holes and other forming system holes with non-shrink grout.

B. CURBS

Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. BASE PLATE, EQUIPMENT BASES AND FOUNDATIONS

Provide machine and equipment bases (housekeeping pad/pier) and foundations, as shown on the Plans. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturers furnishing machines and equipment.

Provide 4-inch-high, square or rectangular concrete pad around all conduits and small diameter pipes that penetrate through floor slabs.

Provide leveling grout under base plates and equipment frames using non-metallic, non-shrink grout. Minimum thickness for leveling grout shall be 1/2 inches unless noted otherwise on the Plans or specified by equipment manufacturer.

3.15 CONCRETE SURFACE REPAIRS

A. PATCHING DEFECTIVE AREAS

Repair and patch defective areas immediately after removal of forms. Cut out honeycomb, rock pockets, voids or bugholes over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. For water and wastewater containment structures, utilize an epoxy resin bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. REPAIR OF FORMED SURFACES

Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, bug holes, honeycomb, rock pockets; fins and other discolorations that cannot be removed by cleaning. Flush out form tie holes and form bolt holes, fill with non-shrink grout, or precast concrete cone plugs or rubber plugs secured in place with bonding agent or epoxy adhesive.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. All repairs shall be approved by the Engineer. If defects cannot be repaired, the Contractor shall remove and replace the concrete.

C. REPAIR OF UNFORMED SURFACES

Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inches wide or which penetrate to reinforcement or

completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3 inches of clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of the Engineer for method and procedure, using specified epoxy adhesive and mortar. Repair methods not specified above may be used, subject to approval of the Engineer. If acceptable repairs cannot be made, the Contractor shall remove and replace the concrete at no cost to the Owner.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. GENERAL

Sampling and testing for quality control during placement of concrete shall include the following:

1. Sampling Fresh Concrete

ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump

ASTM C143: one test at point of discharge for each day's placement of each type of concrete; additional tests when concrete consistency seems to have changed.

3. Air Content

ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231 pressure method for normal weight concrete; one for each day's placement of each type of air-entrained concrete.

4. Concrete Temperature

Test hourly when air temperature is 40 degrees F (4 degrees C) and below, and when 80 degrees F (27 degrees C) and above; and each time a set of compression test specimens is made.

5. Compression Test Specimen

ASTM C31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

6. Compressive Strength Tests

ASTM C39; one set for each day's placement exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any 1 day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

When total quantity of a given class of concrete is less than 50 cubic yards, Engineer may waive strength test if, in their judgment, adequate evidence of satisfactory strength is provided.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations

and provide corrective procedures for protecting and curing the in-place concrete. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

Test results will be reported in writing to Engineer and Contractor within 24 hours after testing. FAX of test results is acceptable; however, mailing hard copies of test results is also required. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

7. Nondestructive Testing

Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection of concrete.

8. Additional Tests

The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in a structure, as directed by the Owner. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for cost of such tests when unacceptable concrete is verified.

3.17 WATERTIGHTNESS

All water and wastewater holding tanks, basins and structures listed on the Structural Plans shall be tested for watertightness. Each tank, structure or basin shall be tested independently.

Watertightness tests shall be made after the concrete has obtained at least 90 percent of its required 28-day compressive strength, but in no case sooner than 20 days after placement. Watertightness shall conform to the requirements of ACI 350.1.

Leakage testing shall not be conducted during periods of time with measurable precipitation. Evaporation correction shall be made on the basis of an evaporation pan. Suitable evaporation pan shall be approved by Owner and shall be provided by Contractor.

Watertightness testing may follow backfill of the structure, at the Contractor's option. However, if the structure does not pass the test, re-excavation to locate leaks shall be required. All costs associated with location (re-excavation and backfilling) and repair of leaks shall be borne by the Contractor.

***** END OF SECTION *****

DIVISION 6

WOOD AND PLASTICS

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shows the extent of rough carpentry work on the Plans, including, but not limited to, the following: wood framing, timber posts and beams, rooftop equipment bases and support curbs, wood nailers and blocking, wood furring, fascia, soffits, and sheathing.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ALSC PS 20	American Lumber Standards Committee (ALSC): American Softwood Lumber Standard
APA PRP-108	American Plywood Association (APA): Performance Standards and Qualification Policy for Structural-Use Panels
APA PS 1	American Plywood Association (APA): Product Standard for Construction and Industrial Plywood
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM D226	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
AWC NDS	American Wood Council (AWC): National Design Specification for Wood Construction
AWC WFCM	American Wood Council (AWC): Wood Frame Construction Manual for one- and two-family dwellings
AWPA U1	American Wood-Preservers' Association (AWPA) Standard
WCLIB 17	West Coast Lumber Inspection Bureau (WCLIB): Standard Grading and Dressing Rules for Douglas Fir, Western Hemlock, Western Red Cedar, White Fir, Sitka Spruce Lumber

1.4 SUBMITTALS

Comply with provisions of Section 01300.

Submit a certificate of compliance from the supplier certifying that the materials provided meet or exceed specified requirements. Certificate shall itemize materials provided on the Project and refer to pertinent specifications.

1.5 DELIVERY, STORAGE AND HANDLING

Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and underneath temporary coverings including polyethylene and similar materials. For lumber and plywood that is pressure treated with waterborne chemicals, provide a sticker between each course to provide air circulation.

PART 2 PRODUCTS

2.1 GENERAL

Lumber shall comply with ALSC PS 20 and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

Each piece of lumber shall be factory marked with Grade Stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill that produced the product.

Nominal sizes are indicated on the Drawings, except as shown by detailed dimensions. Provide actual sizes as required by ALSC PS 20, with moisture content specified for each use.

Provide dressed lumber, S4S, unless otherwise indicated. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.2 FRAMING LUMBER AND FASCIA BOARDS

Unless noted otherwise, provide Douglas Fir - Larch No. 2 or better, or Hem-Fir No. 1 or better.

2.3 BEAMS, STRINGER, POSTS AND TIMBERS

Unless noted otherwise on the Plans, provide Douglas Fir - Larch No. 1 or better. Glue Laminated Lumber: Douglas Fir, coast region. Bottom lamination shall be free of unsound knots or defects larger than 1/2-inch diameter. Provide industrial Appearance Grade. Each member shall bear the American Institute of Timber Construction (AITC) stamp. See Drawings for additional requirements.

2.4 TRIM BOARDS

Unless noted otherwise, provide No. 2 Common Boards or better complying with WWPA rules. Where boards are exposed to finish work, provide 19 percent maximum moisture content. Exterior trim shall be cedar, Grade A or better.

2.5 MISCELLANEOUS LUMBER

Provide wood for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, wood trim, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown or required. Provide Standard Grade Hem-Fir or better. Provide 19 percent maximum moisture content for lumber items not specified to receive wood preservative treatment.

2.6 SHEATHING

Provide APA-rated Exposure 1 unless noted otherwise, span rating and thickness as noted on the Plans.

Comply with PS 1 “Product Standard for Construction and Industrial Plywood” for plywood panels and for products not manufactured under PS 1 provisions, comply with APA PRP-108. Factory-mark each panel with APA trademark evidencing compliance with grade requirements.

2.7 PLYWOOD OTHER THAN SHEATHING

A. BACKING PANELS

For Plywood Backing Panels (or Boards) used for mounting electrical, telephone or communications system equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated on the Drawings. If not otherwise indicated, provide minimum thickness of 15/32 of an inch.

B. SOFFITS

APA A-C Exterior, Exposure 1, thickness as indicated on the Plans, 1/2 inch minimum.

C. SIDING

APA-rated siding - 303; exterior thickness, texture and pattern as indicated on the Plans.

D. MARINE

APA, A-A exterior thickness as indicated on the Plans. HDO (High Density Overlay) faces are acceptable.

2.8 MISCELLANEOUS MATERIALS

A. FASTENERS AND ANCHORAGES

Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable federal specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended fasteners.

Where rough carpentry work is exposed to the weather, in ground contact, or in an area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating per ASTM A153.

B. BUILDING PAPER

ASTM D226, Type I; asphalt saturated felt, non-perforated, 30-lb. type.

C. SILL SEALER GASKETS

Glass fiber resilient insulation fabricated in strip form for use as a sill sealer; 1-inch nominal thickness compressible to 1/32 of an inch; selected from manufacturer's standard width to suit width of sill members.

2.9 WOOD TREATMENT BY PRESSURE PROCESS

Where lumber or plywood is indicated as "P.T." or "Treated," or is specified herein to be treated, comply with applicable requirements of American Wood Preserver's Association (AWPA) Standard U1.

Pressure-treat above-ground items with waterborne preservatives to comply with AWWPA Standard U1. After treatment, kiln dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Pressure treat items indicated on the Plans and all of the following: wood cants, nailer, curbs, top plates, equipment support bases, equipment curbs, plywood, blocking, stripping, and similar members utilized in connection with roofing, flashing, vapor barriers and waterproofing. All wood items including plywood used for or around roof penetrations shall be pressure treated.

PART 3 EXECUTION

3.1 GENERAL

Discard units of material with defects that could impair the quality of the work or with units too small to use in fabricating work with minimum joints or optimum joint arrangement. Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, and similar supports to allow attachment of other work.

Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.2 WOOD NAILERS AND BLOCKING

Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING

Install plumb and level with closure strips at edges and openings. Shim with wood as required to obtain specified tolerance for finished work.

A. FURRING FOR PLYWOOD PANELING

Unless otherwise indicated, provide 1-inch x 3-inch furring at 2-feet on center, horizontally and vertically. Select furring for freedom from knots capable of producing bent over nails and resulting damage to paneling.

B. FURRING FOR GYPSUM DRYWALL

Unless otherwise indicated, provide 1-inch x 2-inch furring at 16-inch on center, vertically.

C. SUSPENDED FURRING

Provide size and spacing shown, including hangers and attachment devices. Level to a tolerance of 1/8 inch in 10 feet.

3.4 WOOD FRAMING, GENERAL

Provide framing members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of the AWC WFCM. Do not splice structural members between supports. Anchor and nail as shown, and to comply with the AWC NDS.

Firestop concealed spaces of wood framed walls and partitions at each floor level and at the ceiling line of the top story. Where firestops are not automatically provided by the framing system used, use closely fitted wood blocks of nominal 2-inch-thick lumber of the same width as framing members.

3.5 STUD FRAMING

Provide stud framing of size and spacing indicated or, if not otherwise indicated, of the following sizes and spacings. Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using 2-inch-thick members with widths equaling that of studs. Nail or anchor plates to supporting construction.

Unless noted otherwise, provide the following minimum framing:

1. For exterior walls provide 2" x 6" wood studs spaced 16-inches on center.

Construct corners and intersections with not less than three studs. Provide miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items and trim.

Provide continuous horizontal blocking row at mid-height of walls and partitions 8 feet high and greater, using 2-inch-thick members of same width of wall or partitions.

Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.

For non-bearing partitions, provide double-jamb studs and headers not less than 4-inches deep for openings 3 feet or smaller in width, and not less than 6-inches deep for wider openings.

For load-bearing partitions, provide double-jamb studs for openings 6 feet or smaller in width, and triple-jamb studs for wider openings. Provide headers of depth shown.

Provide diagonal bracing in stud framing of exterior walls, except as otherwise indicated. Brace both walls at each external corner, full story height, at a 45-degree angle, using either a let-in 1" x 4" or 2" x 4" blocking or metal diagonal bracing. Omit bracing where plywood sheathing, siding and/or gypsum wallboard are indicated to be provided.

3.6 INSTALLATION OF SHEATHING

A. GENERAL

Comply with applicable recommendations contained in the APA "Engineered Wood Construction Guide," for types of construction panels and applications indicated.

B. FASTENING METHODS

Fasten panels as indicated on the Plans. Include metal H clips between sheathing panels.

C. PLYWOOD BACKING PANELS

Nail to supports with minimum 10d at 6-inches on center edge nailing and 12-inches on center at intermediate framing.

***** END OF SECTION *****

SECTION 06190

PREFABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 SCOPE

The extent of Prefabricated Wood Trusses work is shown on the drawings and shall include all labor and materials for the fabrication and installation of the type and configuration of prefabricated wood trusses shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
06100	Rough Carpentry

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ASTM A653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A879	Steel Sheet, Zinc-Coated by the Electrolytic Process
ASTM A924	General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
TPI	Truss Plate Institute
ANSI/TPI 1	National Design Standard for Metal Plate Connected Wood Trusses Construction
WCLIB	West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber
WWPA	Western Wood Products Association

1.4 SUBMITTALS

Comply with provisions of Section 01300.

A. PRODUCT DATA

Submit fabricator's technical data covering lumber, metal plates, hardware, fabrication process, treatment (if any), handling, and erection.

Submit certificate, signed by an officer of fabricating firm, indicating that trusses to be supplied for project comply with indicated requirements.

B. SHOP DRAWINGS

Submit shop drawings showing species, sizes and stress grades of lumber to be used; pitch, span, camber, configuration and spacing for each type of truss required; type, size, material, finish, design values, location of metal connector plates; and bearing and anchorage details.

Provide calculations, which have been signed and stamped by a Structural Engineer licensed in the State of Washington.

C. SINGLE SOURCE RESPONSIBILITY FOR CONNECTOR PLATES

Provide metal connector plates from a single manufacturer.

1.5 QUALITY ASSURANCE

A. TPI STANDARDS

Comply with applicable requirements and recommendations of the following Truss Plate Institute (TPI) publications:

“National Design Standard for Metal Plate Connected Wood Truss Construction.”

“BCSI B1 – Guide for Handling, Installing, Restraining and Bracing Trusses.”

“Commentary for Permanent Bracing of Metal Plate Connected Wood Trusses.”

B. WOOD STRUCTURAL DESIGN STANDARD

Comply with applicable requirements of “National Design Specification for Wood Construction” published by American Wood Council (AWC).

C. MANUFACTURER’S QUALIFICATIONS

Trusses shall be 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 “National Design Standard for Metal Plate Connected Wood Truss Construction.” Trusses shall be designed to support all superimposed dead and live loads indicated, with design

approved and certified by a structural engineer licensed in the State of Washington.

Provide trusses by a manufacturer, which has a record of successfully fabricating trusses similar to type, indicated and which complies with the following requirements for quality control:

Fabricator participates in TPI “Quality Assurance Inspection Program” as a licensee authorized to apply TPI marks to trusses.

1.6 DELIVERY, STORAGE, AND HANDLING

Handle and store trusses with care, and in accordance with manufacturer’s instructions and TPI recommendations to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure.

Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Subject to compliance with requirements, manufacturers which may be incorporated in the work include, but are not limited to, the following:

Alpine Engineered Products, Inc.
Truss Span
Tacoma Truss Systems, Inc.

2.2 LUMBER

Lumber to comply with PS 20 “American Softwood Lumber Standard” and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee’s (ALSC) Board of Review.

Inspection agencies and the abbreviations used to reference lumber grades and species include the following:

NLGA - National Lumber Grades Authority (Canadian).
SPIB - Southern Pine Inspection Bureau.
WCLIB - West Coast Lumber Inspection Bureau.
WWPA - Western Wood Products Association.

Provide lumber to actual sizes required by PS 20 to comply with requirements indicated below:

Dressed, S4S, unless otherwise indicated.

Seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inch or less in nominal thickness, unless otherwise indicated.

Factory mark each piece of lumber with type, grade, mill and grading agency.

2.3 FRAMING LUMBER

Unless noted otherwise, provide Douglas Fir - Larch No. 2 or better, or Hem-Fir No. 1 or better.

2.4 METAL CONNECTOR PLATES, FASTENERS, AND ANCHORAGES

Fabricate connector plates from metal complying with the following requirements:

A. HOT-DIP GALVANIZED STEEL SHEET

Structural (physical) quality steel sheet complying with ASTM A653, Grade 33; zinc coated by hot-dip process to comply with ASTM A924, Designation G60; minimum coated metal thickness indicated but not less than 0.036 inch.

B. ELECTROLYTIC ZINC-COATED STEEL SHEET

Structural (physical) quality steel sheet complying with ASTM A879 Designation 30Z, and, for structural properties, with ASTM A653, Grade 33; zinc-coated by electro-deposition; with minimum coated metal thickness indicated but not less than 0.047 inch.

2.5 FASTENERS AND ANCHORAGES

Provide size, type, material, and finish indicated for nails, screws, bolts, nuts, washers and other anchoring devices.

2.6 FABRICATION

Cut truss members to accurate lengths, angles, and sizes to produce close fitting joints with wood-to-wood bearing in assembled units.

Fabricate metal connector plates to size, configuration, thickness, and anchorage details required for types of joint designs indicated.

Assemble truss member in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with close fitting joints. Position members to produce design camber indicated.

Fabricated wood trusses within manufacturing tolerances of ANSI/TPI 1.

Connect truss members by means of metal connector plates accurately located and securely fastened to each side of wood members by means indicated or approved.

PART 3 EXECUTION

3.1 INSTALLATION

Erect and brace trusses to comply with recommendations of manufacturer and the Truss Plate Institute.

Erect trusses with plane of truss webs vertical (plumb) and parallel to each other, located accurately at design spacings indicated.

Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.

Anchor trusses securely at all bearing points to comply with methods and details indicated.

Install permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.

Do not cut or remove truss members.

***** END OF SECTION *****

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07210

BATT AND RIGID INSULATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install batt and rigid insulation, as indicated on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals

1.3 REFERENCES

This Section references the latest revisions of the following document:

<u>Reference</u>	<u>Title</u>
ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C1289	Standard Specification for Faced Rigid, Cellular Polyisocyanurate Thermal Insulation Board
ASTM C1320	Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

1.4 PERFORMANCE REQUIREMENTS

Materials of this Section shall provide continuity of thermal and vapor and air barriers at building enclosure elements.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Owens Corning, Johns Manville, CertainTeed, DOW, or approved equal.

2.2 MATERIALS

A. BATT INSULATION

Type III preformed, foil-faced, glass fiber batt or roll conforming to ASTM C665, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

B. VAPOR BARRIER

Polyamide (nylon) vapor retarding, 2 mil, sheeting with a variable permeance ranging from 1 perm, or less, up to 10 perms, or greater, based on varying levels of ambient humidity; MemBrain Continuous Air Barrier & Smart Vapor Retarder by CertainTeed, or equal.

C. TAPE

Pressure sensitive, aluminum foil tape; Specialty Tape #425 by 3M, or equal.

D. INSULATION FASTENERS

Galvanized steel impale spindles and clips on 2-inch square flat bases with self adhering backing and length to suit insulation thickness. Include galvanized steel retaining washer(s) of not less than 1-1/2-inches in diameter capable of securely and rigidly fastening insulation in place; by Gemco, or equal.

E. BUILDING WRAP

Mechanically attached water-resistive, vapor permeable air barrier membrane system including primary sheet membrane, self-adhered flashing tape, and flashing primer (as needed). Entire system shall be provided by a single manufacturer. Tyvek CommercialWrap by DuPont, WrapShield IT by VaproShield, or equal.

F. INSULATION BAFFLES

Rigid polystyrene or PVC insulation baffles; Raft-R-Mate by Owens-Corning, AccuVent by Brentwood, or equal.

PART 3 EXECUTION

3.1 EXAMINATION

Verify site conditions before beginning installation. Verify that substrate and adjacent materials are ready to receive insulation, and free of all projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 GENERAL

Comply with insulation manufacturer's written instructions applicable to products and applications.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

Extend insulation to envelop entire area to be insulated with vapor barriers placed to face the interior (warm) side of the envelope. Fill all voids with insulation, fit tightly around all obstructions and tight to the exterior side of mechanical and electrical services within the plane of the insulation. Remove projections that interfere with placement. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-values.

All miscellaneous voids shall have insulation installed to prevent gaps in insulation using either fiberglass batt compacted to approximately 75 percent of normal maximum volume, or spray polyurethane foam applied according to the manufacturer's written instructions.

Prior to installation of finished surfaces, all vapor-retarder joints and ruptures shall be taped and sealed in each continuous area of insulation to ensure an airtight installation.

3.3 INSTALLATION IN FRAMED CONSTRUCTION

Install blanket insulation in all cavities formed by framing members. Use insulation widths and lengths that fully fill the cavities. If more than one length is required to fill cavities, provide lengths that will produce a snug fit between ends. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members, and lap all ends and side flanges of facings over framing members.

Prior to installation of attic insulation, install eave insulation baffles between roof framing members on the underside of roof sheathing in insulated attic spaces at vented eaves.

For wood-framed wall cavities, install blankets according to ASTM C1320 and as specified herein. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

***** END OF SECTION *****

SECTION 07410

METAL ROOF PANELS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes, but is not necessarily limited to, furnishing and installing of all metal roofing, metal fascia, gutters, downspouts, and accessories as indicated on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
06100	Rough Carpentry
06190	Prefabricated Wood Trusses

1.3 SUBMITTALS

Submit in accordance with Section 01300 and as specified herein.

A. PRODUCT DATA

Submit manufacturer's technical product data, installation instructions, and recommendations for Metal Roof Panels used. Include data substantiating that materials comply with requirements.

B. SAMPLES

Prior to ordering products, submit manufacturer's standard color samples for Owner's selection.

C. SHOP DRAWINGS

Show panel layout, trim installation, and panel attachment. Include gutters and downspouts.

D. WARRANTY

1. Manufacturer's Product Warranty

Manufacturer's standard coating performance warranty, as available for specified installation and environmental conditions.

2. Contractor's Warranty

Warrant panels, flashings, sealants, fasteners, and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage for 2 years following project substantial completion date.

1.4 QUALITY ASSURANCE

A. INSTALLER'S QUALIFICATIONS

Installation of panels and accessories by installers with a minimum of 5-years documented experience in metal panel projects of this nature.

B. MANUFACTURER'S QUALIFICATIONS

Manufacturer shall have a minimum of 10-years experience supplying metal roofing/siding to the region where the work is to be done.

C. REGULATORY AGENCY REQUIREMENTS

Comply with IBC and local Building Code requirements if more stringent than those specified.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

Protect panels against damage and discoloration. Handle panels with non-marring slings and do not bend panels. Store panels above ground, with one end elevated for drainage. Protect panels against standing water and condensation between adjacent surfaces. If panels become wet, immediately separate sheets, wipe dry and allow to air dry. Remove any strippable film prior to installation and do not allow to remain on panels in extreme cold, heat or in direct sunlight.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The Bryer Company, Taylor Metal Products, or approved equal.

Panel Designations:

Roof: Interlocking, 2-inch high standing seam panels with a net coverage of 18 inches, factory applied seam sealants, and panel surface striations. TBC-Ultra, or equal.

2.2 MATERIALS

A. PANELS

1. Base Metal

Steel conforming to ASTM A924/ASTM A792 Grade 40 or ASTM A446 Grade C, thickness 24 gauge.

2. Coatings

Protective coatings conform to ASTM A525 G90 or ASTM A924/ASTM A792, AZ50.

3. Finish

Exterior finish includes a 0.2 mil thick corrosion-resistant primer and a 0.8 mil thick finish coat of Polyvinylidene Fluoride (PVF₂), full 70 percent Kynar 500®/Hylar 5000® for a total 1.0 mil dry film thickness.

4. Color

Manufacturer's standard selection of not less than 12 colors including standard and premium options. Provide physical metal color chips for Owner's selection.

B. ACCESSORIES

1. Fasteners

Per manufacturer's recommendations.

2. Sealant

a. Gunnable Grade Caulking: Single component Urethane Caulk.

b. Tape Sealant: Butyl.

3. Profile Closures

Neoprene or polyethylene foam, die-cut or formed to panel configuration.

4. Flashing

Material, gauge, and finish to match panels. Do not use lead or copper.

5. Underlayment

Self-adhered ice and water shield conforming to ASTM D1970.

C. FABRICATION

Unless otherwise shown on the Plans or specified herein, fabricate panels in continuous one-piece lengths and fabricate flashings and accessories in longest practical lengths.

Roofing panels shall be factory formed. Field formed panels are not acceptable.

2.3 GUTTER AND DOWNSPOUT

Provide gutters and downspouts of same material as roof panels, formed from flat sheets. Downspouts anchorage shall conform with SMACNA requirements. Fasteners shall be same material and finish as panel, with soft neoprene washers.

PART 3 EXECUTION

3.1 EXAMINATION

Contractor shall inspect installed work of other trades and verify that such work is complete to a point where this work may continue. Verify that installation can be performed in accordance with approved shop drawings and manufacturer's instructions.

3.2 PREPARATION

A. FIELD MEASUREMENTS

Verify prior to installation. If field measurements differ from Plan dimensions, notify Engineer prior to fabrication.

B. PROTECTION

Treat, or isolate with protective material, any contacting surfaces of dissimilar materials to prevent electrolytic corrosion, comply with

Section 09900. Require workmen who will be walking on roofing panels to wear clean, soft-soled shoes that will not pick up stones or other abrasive material, which could cause damage and discoloration.

C. SURFACE PREPARATION

Clean and dry surfaces prior to applying sealant.

3.3 INSTALLATION

A. PANELS

1. Follow metal panel manufacturer's directions and printed instructions.
2. Install roof panel seams vertically.
3. Lap panels away from prevailing wind direction.
4. Do not stretch or compress panel side-lap interlocks.
5. Secure panels without warp or deflection.

B. ALLOWABLE ERECTION TOLERANCE

Maximum Alignment Variation: 1/4 inch in 40 feet.

C. FLASHING

1. Follow manufacturer's directions and Engineer-approved shop drawings.
2. Overlap roof panels at least 6 inches.
3. Install flashings to allow for thermal movement.
4. Remove any strippable protective film, if used, immediately preceding flashing installation.

D. CUTTING AND FITTING

1. Provide neat, square and true. Torch cutting is prohibited where cut is exposed to final view.

2. Openings 6 inches and larger in any direction: Shop fabricate and reinforce to maintain original load capacity.
3. Where necessary to saw cut panels, debur and treat with galvanic paint coating to match factory color.

3.4 CLEANUP AND CLOSEOUT

A. PANEL DAMAGE AND FINISH SCRATCHES

Do not apply touch-up paint to damaged paint areas that involve minor scratches. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Engineer.

B. CLEANING AND REPAIRING

At completion of each day's work and at work completion, sweep panels, flashing and gutters clean. Do not allow fasteners, cuttings, filings, or scraps to accumulate. Remove debris from project site upon work completion, or sooner, if directed by the Owner.

***** END OF SECTION *****

- B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

- A. Product Warranty: Limited, non-pro-rated product warranty as follows: panels, planks and soffits, 30 years; trim boards, 15 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fiber cement siding and trim shall be as manufactured by James Hardie Building Products, Inc., or equal.

2.2 SIDING AND TRIM PRODUCTS

- A. **LAP SIDING, VERTICAL SIDING, SOFFIT PANELS AND SHINGLES**

Fiber-cement Siding shall comply with ASTM C 1186 Type A Grade II, ASTM E 136, and ASTM E 84 (Flame Spread Index = 0, Smoke Developed Index = 5).

- B. **VERTICAL SIDING PANEL TYPE AND PROFILE**

Type: Sierra 8-inch vertical relief with cedar wood texture; Vertical siding panel 4 feet by 10 feet.

- C. **SHINGLE SIDING TYPE AND PROFILE**

Type: Staggered-edge, notched panel with individual shingle appearance; 48 inches wide by 16 inches high with 7 inch exposure.

D. SOFFIT PANEL TYPE AND PROFILE

Type: Smooth vented, factory sealed on 5 sides with 5 square inches of net free ventilation per linear foot, 24 inches by 8 feet by 1/4 inch thick.

E. TRIM

1. 5/4 trim boards with rustic texture, width and length as required.

2.3 FINISH

A. Primer: Provide factory applied universal primer.

B. Top Coat: Refer to Exterior Finish Schedule per 09 90 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Contractor shall inspect and approve building framing and substrates. Notify Owner of any unsatisfactory conditions before proceeding.

3.2 LAP SIDING INSTALLATION

A. Install materials in strict accordance with manufacturer's installation instructions.

B. Install a minimum 1/4 inch thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches wide laps at the top. The bottom edge of the first plank overlaps the starter strip.

C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.

D. Align vertical joints of the planks over framing members.

E. Maintain clearance between siding and adjacent finished grade.

F. Use off-stud metal joiner in strict accordance with manufacturer's installation instructions.

SECTION 07900

CAULKING AND SEALANTS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install caulking and sealants, as indicated on the Plans and as specified herein.

All exterior wall joints and interior and exterior joints between all differing or dissimilar materials and at windows, doors, roof penetrations, louvers and similar types of openings shall receive sealants to make the joint air and watertight. This includes concrete to CMU, concrete to wood, CMU to wood, concrete to sheet metal, CMU to sheet metal, etc.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
Division 3	Concrete
Division 6	Wood and Plastics
Division 7	Thermal and Moisture Protection
Division 8	Doors and Windows

1.3 REFERENCE STANDARDS

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
AAMA 800	Sealant Manual, Specifications and Test Methods for Sealants
ASTM C834	Standard Specification for Latex Sealants
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1193	Standard Guide for Joint Sealants
ASTM C1311	Standard Specification for Solvent Release Sealants

ASTM D5249	Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D7174	Standard Specification for Preformed Closed-Cell Polyolefin Expansion Joint Fillers for Concrete Paving and Structural Construction
NSF/ANSI 61	Drinking Water System Components – Health Effects

PART 2 PRODUCTS

2.1 POLYURETHANE SEALANTS

Provide a one-component, gunnable grade, non-sag, solvent-free polyurethane sealant. The sealant shall cure under the influence of atmospheric moisture. Sealant shall meet ASTM C920, Type S, Grade NS, Class 35, under uses NT, T, M, G, I, A, and O. Performance characteristics shall include a 175 psi 21-day tensile strength, a minimum 500-percent ultimate elongation, and a maximum Shore “A” Hardness of 45.

Polyurethane sealants shall be Sikaflex-1a, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

2.2 SILICONE SEALANTS

Provide a one-component, gunnable grade, neutral cure, silicone sealant. Sealant shall meet ASTM C920, Type S, Grade NS, Class 50, under uses NT, M, G, A and O. Performance characteristics shall include a 200 psi 21-day tensile strength, a minimum 700-percent ultimate elongation, and a maximum Shore “A” Hardness of 25.

Silicone sealants shall be Sikasil WS-295, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

2.3 ACRYLIC LATEX CAULK

Provide a one-component, gunnable grade, pure acrylic latex sealant. Sealant shall meet ASTM C834, Type OP, Grade -18 °C. Performance characteristics shall include a maximum 25-percent shrinkage, and a movement capability of plus/minus 12.5-percent.

Acrylic latex sealants shall be Tremflex 834, as manufactured by the Tremco, Inc. or equal by BASF Corporation.

2.4 TAPE SEALANT

Provide a 100-percent solid, isobutylene preformed sealant tape. Tape sealant shall meet the American Architectural Manufacturer's Association AAMA 807.3 standard. Performance characteristics shall include a density of 1.5 and a minimum peel adhesion of 8 pounds per inch.

Tape sealant shall be Sikalastomer-95, as manufactured by the Sika Corporation, or equal by Tremco, Inc. or BASF Corporation.

PART 3 EXECUTION

3.1 GENERAL

All sealant and primer work shall comply with ASTM C1193 and with the manufacturer's written instructions.

The Contractor shall confirm that the proposed sealant and primer materials are compatible with any concrete curing compound used, or the Contractor shall lightly sandblast and thoroughly clean concrete joint surfaces prior to application of sealant materials.

All priming and sealant work shall be done under temperature and moisture conditions that are within the requirements of the manufacturer's written instructions.

All exterior dissimilar materials shall be sealed with elastomeric sealants at the joints between the different materials.

3.2 APPLICATION OF SEALANTS

A. PREPARATION OF JOINTS

Inspect profiles and surfaces of all joints prior to application. Verify joint dimensions are adequate for development of the sealant movement capability. All joints shall be solvent cleaned, dry, and free of dust, oils and grease before receiving backing materials and sealant. Floor joints shall be wire brushed, free of laitance or other residues. Aluminum or other metal surfaces to be in contact with sealants shall be wiped clean with xylol or an MEK solvent to remove any coatings or contamination. Joint sealants shall be installed before other surface finishes are applied. Proceed with joint sealant work only once conditions meet the manufacturer's requirements.

B. BACKINGS

Install filler and backer materials in as long of lengths as practicable. Stretch and force into joints with tool designed for that purpose, to a uniform depth, as indicated on the Plans or as required by the manufacturer, allowing for installation of sealant and caulking. Provide filler material in slab shapes for joints 1/2 inch or more in depth, and in 3/4 inch or more wide joints to receive sealing material. Provide extruded rod backer material in all other joints to receive sealant. Filler or backer material shall be of a depth as required to bring the top surface to within 1/2 inch of the slab surface, or as indicated on the Plans. All joints shall include a suitable bond breaker between backing materials and sealant.

C. MASKING

Both sides of joints shall be masked with tape to prevent soiling floor, slab, or wall beyond limits of the joint.

D. PRIMING

Apply primer to all surfaces of joints in contact with sealant materials. Apply full strength and undiluted in a uniform coating of surface. Allow to set or cure prior to proceeding. Do not prime surfaces at back of joint.

E. APPLICATION

Sealant shall be gun applied, giving the joint a full bead of sealant. Skin beads are not acceptable. Tool the bead immediately after application to ensure a firm and full contact with the inner faces of the joint. Joints in sills and other wash surfaces shall be filled slightly convex to obtain a flush joint when dry. Entire perimeter of openings in concrete surfaces shall be sealed. Do not apply sealants to wet or damp surfaces nor in temperatures below 50 degrees F, and as required by the manufacturer. Strike off excess sealant with tooling stick or a knife so that finished bead is slightly below surface. Remove excess sealant as work progresses. Sealants in masonry wall joints are to be a maximum of 1/2-inch deep and not less than 1/4 inch in each dimension. When applying sealant, do not permit thickness of sealant to exceed 1/2 of the width of the joint. Any joints over 1/2-inch wide shall be reported to the Owner and instructions for correcting the applications will be given.

3.3 CLEANUP

Upon completion, the Contractor shall remove and dispose of masking materials. Remove any excess materials and clean adjacent surfaces free from any soiling or staining resulting from the sealing and caulking operations.

***** END OF SECTION *****

DIVISION 8

DOORS AND WINDOWS

SECTION 08110

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers furnishing and installing hollow metal doors, frames, and glazing as indicated on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
07900	Caulking and Sealants
08700	Finish Hardware
09900	Painting

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ANSI/SDI A250.8	Specifications for Standard Steel Doors and Frames
ANSI/SDI A250.11	Recommended Erection Instructions for Steel Frames
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
HMMA 840	Guide Specification for Installation and Storage of Hollow Metal Doors and Frames

1.4 QUALITY ASSURANCE

Hollow metal doors and frames shall conform to applicable requirements of ANSI/SDI A250.8.

1.5 SUBMITTALS

Submit shop drawings and product data under provisions of Section 01300.

Indicate frame configuration, anchor types and spacing, location of cutouts for hardware, reinforcement, and finish.

The inside of the metal frame profile shall be coated per Section 09900 of these Specifications. Provide dissimilar metals system. Coating may be shop or field applied.

2.6 LOUVERS

Doors with louvers shall be furnished with a 50-percent free area, inverted "Y" louver with an integral insect screen, security screws and security grille. Louver shall include 18 gauge galvanized steel frame and 20 gauge louver blades. Size shall be as shown on the plans. Color shall be selected by Owner from manufacturer's stock powder coat system colors. Door louvers shall be the Rockwood LV-IY Series, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

Frames shall be installed plumb, level, and rigid in accordance with ANSI/SDI A250.11 and with HMMA 840. Doors shall be installed in accordance with HMMA 840.

Coordinate with all wall construction types for proper anchor placement. All door frames shall be fully grouted with non-shrink grout after installation of the frame.

Install roll formed steel reinforcement channels between two abutting frames and anchor frames to structure and floor.

Contractor shall protect doors and frames as necessary during construction of the Project.

3.2 CLEARANCES AND TOLERANCES

Clearances between the door and frame head and jambs shall be 1/8 of an inch. Clearances between the meeting edges of pairs of doors shall be 3/16 of an inch plus or minus 1/16. Maximum diagonal distortion shall be 1/8 of an inch, measured with straight edge, from corner to corner. Clearance between the face of the door and the door frame stops shall be 1/16 to 1/8 of an inch.

3.3 ADJUSTING DOORS

Adjust hardware for smooth and balanced door movement.

***** END OF SECTION *****

SECTION 08330

COILING OVERHEAD DOORS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of furnishing and installing coiling doors as indicated on Plans and specified herein. The Contractor shall also provide and install operating hardware and supports.

1.2 RELATED SECTIONS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
06100	Rough Carpentry
07900	Caulking and Sealants

1.3 SUBMITTALS

A. PRODUCT DATA

Submit manufacturer's product data and installation instructions for coiling door. Include specific data prepared for this project.

B. SHOP DRAWINGS

Submit shop drawings for approval prior to fabrication. Include detailed plans, deviations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.

1.4 OPERATION AND MAINTENANCE DATA

The Contractor shall provide manufacturer's operation and maintenance data; include data for transmission, shaft and gearing, lubrication frequency, spare part sources.

1.5 QUALITY ASSURANCE

A. MANUFACTURER

Coiling door shall be manufactured by a firm with a minimum of 10-years experience in the fabrication and installation of coiling doors. Manufacturers proposed for use, which are not named in these

Specifications, shall submit evidence of ability to meet performance and fabrication requirements specified, and include a list of five projects of similar design and complexity completed within the past 5 years.

B. INSTALLER

Installation of coiling door shall be performed by an authorized representative of the manufacturer.

C. SINGLE-SOURCE RESPONSIBILITY

Provide doors, guides, and related primary components from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

D. PRE-INSTALLATION CONFERENCE

Schedule and convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures, and construction operations.

1.7 WARRANTY

Provide a manufacturer's 2-year warranty for the door and operator system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Wayne Dalton, or approved equal.

2.2 MATERIALS

800C Series Insulated Service Door.

A. CURTAIN

Interlocking roll-formed slats with endlocks attached to each end of alternate slats to prevent lateral movement.

1. Flat profile. The front slat shall be fabricated of 18-gauge galvanized steel. The back slat shall be 24-gauge galvanized steel.
2. Slat cavity shall be filled with CFC-free foamed-in-place, polyurethane insulation for an R-value of 7.7.

B. FINISH

Slats and hood shall be galvanized steel in accordance with ASTM A653 and receive rust-inhibitive, roll coating process, including bonderizing, 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester (powder coated) top coat. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.

C. COLOR

Powder coating finish in color as selected by the Owner from manufacturer's standard colors.

D. WINDLOAD DESIGN

Design and size components to withstand loads caused by pressure and suction of wind acting normal to the plane of wall as calculated in accordance with the design parameters shown on the Contract Drawings, current applicable code(s), and for a minimum of 22 PSF.

E. WEATHERSEALS

Vinyl bottom seal, exterior guide and internal hood seals; with optional air infiltration package to reduce air infiltration to less the 1.0 cfm per square foot of door area.

F. BOTTOM BAR

Two prime painted galvanized steel angles, minimum thickness 1/8-inch bolted back to back to reinforce curtain in the guides.

G. GUIDES

Three galvanized structural steel angles with minimum thickness of 3/16 inch. Guides shall be weatherstripped with a vinyl weather seal at each jamb, on the exterior curtain side.

H. BRACKETS

Hot rolled galvanized steel to support counterbalance, curtain, and hood.

I. COUNTERBALANCE

Helical torsion spring type designed for standard 20,000 cycle life design. Counterbalance shall be housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance shall be adjustable by means of an adjusting tension wheel.

J. HOOD

Galvanized steel, 24-gauge hood with intermediate supports as required. Provide with internal hood baffle weatherseal.

K. OPERATION

Provide manual chain hoist back up operation in the event of electric operation failure.

L. WALL MOUNTING CONDITION

Face-of-wall mounting.

PART 3 EXECUTION

3.1 EXAMINATION

The Contractor shall verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits. Beginning of installation means installer acceptance of existing surfaces.

3.2 PREPARATION

The Contractor shall prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

3.3 INSTALLATION

The Contractor shall install door unit assembly in accordance with manufacturer's instructions. Anchor assembly to wall construction and building framing without distortion or stress. Securely brace door tracks suspended from structure. Secure tracks to structural members only. Fit and align door assembly including hardware, level, and plumb, to provide smooth operation. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

Provide all electrical conduit and conductors as necessary to fully wire and interconnect the door operator control stations and safety devices work in conformance with Division 16 specifications and the electrical Contract Drawings.

3.4 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation from Plumb: 1/16 inch.
- C. Maximum Variation from Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch with the use of a 10-foot-long straight edge.

3.5 MANUFACTURER'S FIELD SERVICES

Prepare, adjust and startup system. Ensure the operation and adjustments to door assembly for smooth operation.

3.6 ADJUSTING

The Contractor shall adjust door assembly to smooth operation.

3.7 CLEANING

The Contractor shall clean door and frames. Remove labels and visible markings. Touchup damaged coatings and finishes and repair minor damage.

3.8 PROTECTION OF FINISHED WORK

The Contractor shall protect finished work after the installation. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

***** END OF SECTION*****

SECTION 08620

PLASTIC UNIT SKYLIGHTS

PART 1 GENERAL

1.1 SCOPE

The Contractor shall furnish and install plastic skylight and frames; as shown on the Plans and as specified herein. The Contractor shall also install all accessories for proper flashing in accordance with the manufacturer's recommendations.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
07900	Caulking and Sealants

1.3 REFERENCES

This section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
AAMA	North American Fenestration Standard/Specification for Windows, Doors, and Skylights

1.4 PERFORMANCE REQUIREMENTS

- A. Unit skylights shall be certified by National Accreditation & Management Institute and rated by the National Fenestration Rating Council (NFRC) for thermal performance as follows.
 1. Acrylic Triple Domes
 - a. U-Factor: 0.50
 - b. SHGC: 0.57
 - c. VT: 0.63
- B. Unit skylights shall be certified by the National Accreditation & Management Institute to North American Fenestration Standard AAMA 101 for air and water penetration and structural loading as follows.

1. Acrylic Triple Domes
 - a. MST: SKP-C30 50" x 50"
 - b. Design Pressure (Download): 45 psf
 - c. Negative Design (Uplift): 30 psf
 - d. Water Resistance: 6.0 psf
- C. Skylight glazing shall demonstrate performance which exceeds Occupational Safety and Health Administration (OSHA) requirements for providing fall protection by the application of dynamic loads of a 200 pound impact bag dropped from a height of 6 feet twice and 7 feet once, thus applying dynamic loads of 1,200 and 1,400 ft-lbs of force, respectively, all on the same test specimen; remaining undamaged after impacts.

1.5 QUALIFICATIONS

The manufacturer shall specialize in the products specified in this Section and shall have a minimum of 5-years documented experience.

1.6 SUBMITTALS

Submittals shall be in accordance with Section 01300.

A. PRODUCT DATA

Submit manufacturer's product data and installation instructions for skylight. Include specific data prepared for this project.

B. SHOP DRAWINGS

Submit shop drawings for approval prior to fabrication. Include detailed plans, deviations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.

C. CERTIFICATES

Submit manufacturer's certificate certifying that each product meets or exceeds specified requirements.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Crystalite Inc., Velux, or equal.

2.2 MATERIALS

A. ALUMINUM

Aluminum extruded components shall be ASTM B 221 alloy 6063-T5 or 6063-T6, of a thickness as required per the manufacturer's structural calculations. Aluminum sheet and plate shall be ASTM B 209 alloy 5052-H32.

B. GLAZING

Impact Modified Acrylic Plastic, shall meet or exceed the following:

1. ICC-ES listings as CC2 approved plastic complying with Section 2606.4 of the IBC
2. ANSI Z97.1 Safety Glazing Requirements
3. Underwriters Laboratories (UL) listings as UL 94HB and UL746 Compliant
4. Miami-Dade County Product Notice of Acceptance-Plastics
5. ASTM D-4802 B-1 Plastics
6. Plaskolite Optix White Acrylic Sheet has a measured haze value greater than 90 percent.

2.3 CURBS

Aluminum plate and sheet for curb fabrication shall match construction of skylights. Curb shall be self-flashing and shall be insulated with rigid foam plastic thermal insulation board composed of polyisocyanurate foam core bonded to reinforced aluminum foil facers on each side. Thickness shall be 1" nominal providing 5.9 R-Value.

2.4 ACCESSORIES

The anchoring devices shall be stainless steel and in accordance with the manufacturer's recommendations. The counterflashings shall be of the same metal type and finish as skylight frame and the sealants shall be in accordance with Section 07900 of these Specifications.

2.5 FABRICATION

The plastic unit skylights shall be free of visual distortion and defects and shall be fabricated to provide a weather tight assembly.

Bituminous paint shall be applied to all aluminum surfaces of the units in contact with cementitious materials or dissimilar metals.

2.6 FINISHES

The finish shall be clear anodized aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

The Contractor shall coordinate this section with dimensions, tolerances, and method of attachment with other adjacent work include, but not limit to, the installation of wood curbs and roofing system. The Contractor shall also verify that the openings and adjoining air and vapor seal materials are ready to receive the work specified in this Section.

3.2 INSTALLATION

The Contractor shall install all units in accordance with the manufacturer's instructions. Place unit and secure to curb frame. Flash into roof system. Apply sealant to the assembly to provide weather tight installation.

***** END OF SECTION *****

SECTION 08700

FINISH HARDWARE

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section specifies that the Contractor shall provide complete finish hardware and suitable fastenings for the project. Quantities listed in any instance are for supplier convenience only and are not guaranteed.

Finish hardware includes items known commercially as “builders’ hardware” required, for swinging doors. Hardware specified in the same section as the door and/or doorframe will be furnished by the supplier of that Section.

All hardware furnished in this Section shall comply with the requirements of all applicable codes. All items specified in this Section shall be furnished by a factory-authorized distributor maintaining parts, stocks, and services for standard specified items.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
08110	Hollow Metal Doors and Frames

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
UL	Building Materials List

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURER’S

Finish hardware shall be as manufactured by the suppliers listed in the following sections.

2.2 BUTTS

Butts shall be 4-1/2" x 4-1/2" (minimum 1.4 lbs each) for 3'-0" wide and under, and 5" x 4-1/2" (minimum 1.67 lbs each) for over 3'-0" wide, except as required

for 180-degree swing and shall be of the type listed. Doors up to and including 90 inches in height shall have 1-1/2 pair and doors over 90 inches in height shall have two pair. For unusual size or weight doors, furnish type, size, and quantity recommended by the butt manufacturer. All exterior-outswinging doors shall have non-removable pins. Butts shall be of the concealed bearing type with anti-friction, self-lubricating hinges. Butts shall be as manufactured by McKinney, or equal.

2.3 LOCKSETS

Locksets shall be Grade 1 mortise locksets with 2-3/4-inch backsets and 3/4-inch antifriction latch bolt, as manufactured by Corbin Russwin, or equal. All locksets and latchsets shall be the product of one manufacturer. Functions as indicated in the hardware groups. Provide curved lip strikes. Deadbolt functions shall be 1-inch projection.

Locksets and latchsets shall be furnished with sufficient strike lip to protect trim. (note: 3/4-inch latch bolts require 3/4-inch minimum clearance for trim, otherwise extended lip strikes must be furnished).

All locks shall have wrought box strikes.

2.4 STOPS

All doors are to have a wall stop or floor stop unless otherwise specified. Where wall stops are specified but cannot be used, substitute a floor stop. If wall stop or floor stop cannot be used, advise the Owner of the specific door during submittal process. Provide proper height floor stops to suit conditions. Contractor to provide solid backing for all wall mounted stops. Stops shall be as manufactured by Trimco; 1200 series floor stop, 1270 series wall stop, or equals.

2.5 GASKETS AND THRESHOLDS

Gaskets and thresholds shall be as specified in the hardware groups and shall be as manufactured by Pemko, or equal.

2.6 KEYING

All cylinders shall be furnished with visual key control with key code stamped on the face of the keys and marked on the back or side of the cylinders. All cylinders shall be furnished with construction-keyed cores as required by the Contractor.

Final keying of the cylinders shall be coordinated with the Owner to match their current keying protocols.

2.7 KEY QUANTITIES

Keys shall be furnished in the following quantities:

<u>Type</u>	<u>Quantity</u>
MKs	6 each
Construction Keys	6 each
Change keys per keyed cylinder	2 each
Control keys	2 each

2.8 HARDWARE GROUPS

A. MANUFACTURER'S LIST

<u>Manufacturer</u>	<u>Abbreviation</u>
Corbin Russwin	CO
McKinney	MK
Pemko	PE
Trimco	TR

B. Refer to door schedule and related information concerning the following hardware groups:

HW1 (exterior secure single door)

	Butts TCA 3386, 630	MK
1 ea.	Lockset ML2051 LWA, 630	CO
1 ea.	7-Pin IC Cylinder 1080-112-A01, 630	CO
1 ea.	Wall stop 1270	TR
1 ea.	Threshold 2715 APK	PE
1 ea.	Door bottom 210 AK	PE
1 set	Gaskets 2891, 290 AK	PE

PART 3 EXECUTION

3.1 INSTALLATION

Refer to A.S.A.H.C., B.H.M.A., and S.D.I. for mounting heights.

Unless a conflict arises, the following are standard mounting heights on some products. If a question or conflict should arise, the hardware supplier, if requested, shall assist the Contractor and Owner in determining mounting heights. All measurements are from finish floor except top butt.

A. BUTTS

Top 11-3/4-inch center of butt to top of door. Intermediate equal distance between top and bottom butts. Bottom 13-inch center of butt.

B. KNOB LOCKS

40-5/16 inch to center of strike.

C. DEADLOCKS

60 inch to center of strike.

D. PUSH PLATES

45 inch to center.

E. PULL PLATES

42 inch to center.

3.2 ADJUSTING

Hardware shall be adjusted for correct operation.

After installation of hardware and before the building is accepted, Contractor shall inspect the installation and certify that the hardware is correctly installed in accordance with the manufacturer's recommendations. Hardware installer shall make any necessary adjustments.

***** END OF SECTION *****

DIVISION 9

FINISHES

SECTION 09900

PAINTING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers the furnishing and installation of protective coatings, complete-in-place. Special shop coatings and/or factory-applied finishes on manufactured or fabricated items may be specified elsewhere. Regardless of the number of paint coats previously applied, at least two field coats of paint shall be applied to all surfaces unless otherwise specified herein. Field painting is not required for factory prefinished equipment items such as pumps, blowers, motors, etc. Touchup of the factory applied coatings may be required.

The word “paint” as used herein shall be taken to include all protective coatings and incidental materials as required with the exception that anodized aluminum or zinc galvanized coatings shall not be considered as paint.

Unless specifically noted otherwise in these Specifications or on the Plans, all work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If an existing wall or ceiling (or similar surface) is modified in some way, the entire wall or ceiling surface is to be painted.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
03300	Concrete
07900	Caulking and Sealant
08100	Hollow Metal Doors and Frames
Division 11	Equipment
Division 13	Special Construction
Division 14	Conveying Systems
Division 15	Mechanical
Division 16	Electrical

1.3 REFERENCED STANDARDS

The following standards are referenced and shall be considered a part of these Specifications:

American National Standards Institute (ANSI):

A159.1, Surface Preparation Specifications;
Z53.1, Safety Color Code for Marking Physical Hazards

American Society for Testing and Materials (ASTM):

D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
E84, Standard Test Method for Surface Burning Characteristics of Building Materials

National Fire Protection Association (NFPA):

101, Life Safety Code

Steel Structures Painting Council (SSPC):

SP-1, Solvent Cleaning
SP-2, Hand Tool Cleaning
SP-3, Power Tool Cleaning
SP-5, White Metal Blast Clearing
SP-6, Commercial Blast Cleaning
SP-7, Brush-off Blast Cleaning
SP-10, Near-White Blast Cleaning
SP-11, Power Tool Cleaning
SP-13 Surface Preparation for Concrete Surfaces
VIS-89, Visual Standard

1.4 DEFINITIONS

A. PAINT

Includes fillers, primers, sealers, emulsions, oils, alkyds, latex, enamels, thinners, stains, epoxies, vinyls, urethanes, shellacs, varnishes and any other applied coating specified within these Specifications or shown on the Plans.

B. FINISHED ROOM OR SPACE

One that has a finish called for on Room Finish Schedule, or is indicated on the Plans, or is specified herein, to be painted.

C. PAINTING COVERAGE RATE

Coverage's expressed in SF/GAL/coat are the manufacturer's published theoretical coverage's in square feet per gallon per coat.

1.5 SUBMITTALS

In addition to the general submittal requirements listed in Section 01300, the following shall be submitted:

1. Written acknowledgment and certification that products submitted meet requirements of standards referenced in this Section.
2. Manufacturer's application instructions for primer and finish coats.
3. Manufacturer's surface preparation instructions.
4. Manufacturer's full line of color samples for color selection by Owner.
5. If products being used are manufactured by a company other than the specified reference standard, the Contractor must provide a complete comparison of the proposed products with the specified reference products per Part 2.1 requirements, including application procedure, coverage rates, and verification that product is designed for intended use. Information must be provided that demonstrates that manufacturer's products are equal to the performance standards of products manufactured by the Tnemec Company, which is the reference standard.
6. Manufacturer's approval of protective coating systems applicator.
7. List of Applicator's experience and qualifications. A minimum of 5-years of experience in the painting of facilities required.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The following is an approved coating systems manufacturers list subject to compliance with the Specifications contained herein:

1. Ameron Protective Coatings Division.
2. Sherwin Williams.
3. Tnemec Company.
4. Or equal.

The specified coating shall be understood as establishing the type and quality of coating desired. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Engineer to determine that the coatings proposed are equivalent to those named. Proposed coatings shall be submitted for review in accordance with these Specifications. Requests for review of equivalency will not be accepted from anyone except the Contractor, and such requests shall not be considered until after the Contract has been awarded.

No substitutions shall be allowed that change the number of coats, thickness or generic type of paint required. All materials shall be brought to the jobsite in the original sealed and labeled containers of the paint manufacturer and shall be subject to inspection by the Engineer.

No coating materials other than those specified shall be brought to the jobsite. Thinners, driers and oils brought to the jobsite shall be only those recommended and approved by the paint manufacturer.

All paint shall conform to the applicable air quality regulations at the point of application. Any paint material which cannot be guaranteed by the manufacturer to comply, whether specified by product designation or not, shall not be used.

It shall be the responsibility of the Contractor to ensure the compatibility of the field painting products which will be in contact with each other or which will be applied over shop painted or previously painted surfaces. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to the underlying paint.

All paint used for intermediate and finish coats shall be guaranteed by the paint manufacturer to be fumeproof and suitable for wastewater plant atmospheres containing hydrogen sulfide. Any paint that cannot be so guaranteed shall not be used. Paint shall be lead-free and mercury-free if available, but in no case shall the lead or mercury content cause discoloration in a wastewater plant atmosphere.

Tnemec Company products are the reference standard and Tnemec designations for product type are used herein. Requirements for an approved equal product are listed below:

1. For approval of an equal manufacturer. The Contractor shall provide to the Owner in writing a detailed side-by-side comparison of the proposed equal Products Characteristics, Performance Characteristics, and Application Conditions for each Tnemec coating specified in this specification. For consideration for approval this written comparison shall be certified and notarized by an officer of the proposed manufacturer as true and correct.

2. For Products Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Volume Solids, Weight Solids, VOC, Mix Ratio, Zinc Content in Dry Film (by Weight), Spreading Rate per coat, Drying Schedule, Shelf Life and Flash Point.
3. For Performance Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Abrasion Resistance, Corrosion Weathering, Direct Impact Resistance, Dry Heat Resistance, Flexibility, Moisture Condensation Resistance, Pencil Hardness, Salt Fog Resistance, Slip Coefficient and Wet Heat Resistance
4. In addition to the detailed side-by-side comparison for approval of an equal manufacturer, The Contractor shall provide to the Owner in writing five similar installations that have had the proposed or equal coating system and date coating system was put into service. In addition the installations names, locations, and owner's name with contact person and telephone number shall be provided.
5. For consideration for approval as an equal coating system the detailed side-by-side comparison shall be submit, with successful bidder's Shop Drawing at the time of the Preconstruction Conference, along with any proposed monetary adjustments to the contract price. As with all shop drawings, final approval rests with the Owner.
6. As a minimum standard any equal coating system shall have a 5-year service history on its coating system.

2.2 PAINT SYSTEMS

A. COATING OF FACTORY NON-APPROVED FINISHES

1. Scope

This Section shall apply to all interior and exterior steel windows and frames and other similar type of items which have a factory finish which is not an approved corrosion resistant finish.

2. Surface Preparation

Factory coating is to remain. Provide clean surfaces, lightly sand 100 percent of the surfaces, then provide solvent cleaning, SSPC-SP-1.

3. Coatings

Primer System:

Coat One

Product: Typoxy Tnemec Series N27

MDFT: 2 to 3 mils

Finish System:

Coat One

Product: Endura-Shield Tnemec Series 1095

MDFT: 3 to 5 mils

Total MDFT: 5.0 to 8.0 mils

B. STRUCTURAL STEEL - MILD CONDITIONS

1. Scope

This Section shall apply to all interior structural steel. Items which are interior but may be exposed to splashing of liquids or corrosives shall be coated for severe conditions.

2. Surface Preparation

Commercial blast cleaning, SSPC-SP-6.

3. Coatings

Shop Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Field Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4 to 6 mils

Coat Two

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4 to 6 mils

Total MDFT: 10.5 to 15.5 mils

C. DUCTILE IRON PIPE AND FITTING MATERIALS (IMMERSION)

1. Scope

This Section shall apply to exposed ductile iron pipe, fittings and materials that are continuously or intermittently submerged or exposed to splash or spill of liquids or corrosive atmospheres. This includes all ductile iron materials installed in a wet well, sump, manhole, vault, pullhole, or similar type of structure. Non-immersion service is covered elsewhere in this Specification.

2. Surface Preparation

Provide surface profile in accordance with ASTM D 4417, Method C

3. Coatings

Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 8 to 10 mils

Coat Two

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 8 to 10 mils

Total MDFT: 18.5 to 23.5 mils

D. DUCTILE IRON PIPE AND FITTING MATERIALS (NON-IMMERSION)

1. Scope

This Section shall apply to exposed ductile iron pipe, fittings and materials that are not continuously or intermittently submerged. Continuously or intermittently submerged items are covered elsewhere in this Specification.

2. Surface Preparation

Provide surface profile in accordance with ASTM D 4417, Method C

3. Coatings

Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4 to 6 mils

Coat Two

Product: Endura-Shield Tnemec Series 1095

MDFT: 3 to 5 mils

Total MDFT: 9.5 to 14.5 mils

E. GALVANIZED SURFACE TOUCHUP

1. Scope

This Section shall apply to all galvanized surfaces, which have received minor damage to the galvanized surface during construction.

2. Surface Preparation

Power tool cleaning, SSPC-SP-3.

3. Coatings

Paint System:

Product: PerimePrime Tnemec Series 394

MDFT: 3 to 5 mils

Total MDFT: 3.0 to 5.0 mils

F. METAL DOORS, FRAMES AND TRIM

1. Scope

This Section shall apply to all interior and exterior hollow metal doors, frames and trim.

2. Surface Preparation

All hollow metal doors and frames shall be bonderized, pickled or phosphatized, which will serve as the primer for and shall be compatible with the finish coats to be applied in the field. Prior to field coat application, the surface shall be solvent cleaned SSPC-SP-1, and shall be clean, dry and free of all dirt, oil, grease and any other contaminants.

3. Coatings

Primer System:

Coat One

Product: Tnemec Series 27 Typoxy

MDFT: 3 to 5 mils

Finish System:

Coat One

Product: Endura-Shield Tnemec Series 1095

MDFT: 3 to 5 mils

Total MDFT: 6.0 to 10.0 mils

G. EXTERIOR SIDING, SOFFITS AND TRIM

1. Scope

This Section shall apply to all exposed to view exterior siding, soffits and trim for buildings and structures. Color shall be selected by the Owner.

2. Surface Preparation

Surfaces shall be clean and dry. Sand wood as required.

3. Coatings

Primer System:

Product: Electrogrip, Tnemec Series 151
MDFT: 1.5 to 2 mils

Finish System:

Coat One:

Product: Envirocrete, Tnemec Series 156
MDFT: 3 to 4 mils

Coat Two:

Product: Envirocrete, Tnemec Series 156
MDFT: 3 to 4 mils

Total MDFT: 9 mils

H. PAINTED WOOD AND WOOD TRIM

1. Scope

This Section shall apply to all exposed to view interior and exterior wood and wood trim for buildings and structures. Color shall be selected by the Owner.

2. Surface Preparation

Wood surfaces shall be clean and dry. Sand wood as required.

3. Coatings

Primer System:

Product: Electrogrip, Tnemec Series 151
MDFT: 1.5 to 2 mils

Finish System:

Coat One:

Product: Envirocrete, Tnemec Series 156
MDFT: 3 to 4 mils

Coat Two:

Product: Envirocrete, Tnemec Series 156
MDFT: 3 to 4 mils

Total MDFT: 7.5 to 10.0 mils

2.3 COLORS

A. GENERAL

Paint colors used for the finish coatings on process equipment, piping and building surfaces shall conform to the following schedules. All finishes shall be glossy unless otherwise specified. Finish coatings, which are applied in the shop by the manufacturer, shall conform with this color schedule wherever possible. Factory coatings which are damaged during shipment or installation, or which are not of suitable color, as determined by the Engineer, shall be recoated in the field in accordance with these Specifications. Color samples shall be submitted to the Engineer for approval prior to application of any field coatings.

B. PIPING COLOR SCHEDULE

Piping Identification: Exposed piping and piping in accessible chases shall be identified with lettering or tags designating the service of each piping system, shall have flow directional arrows, and shall be color coded as scheduled below.

Piping scheduled to be color coded shall be completely painted with the indicated colors, except surfaces specified to be unpainted shall have segments painted with the specified coding color long enough to accommodate the required lettering and arrows. All other piping specified to be painted shall match adjacent surfaces, unless otherwise approved by the Engineer.

Location: Lettering and flow direction arrows shall be provided near equipment served, adjacent to valves, on both sides of walls and floors where pipe passes through, at each branch or tee, and at intervals of not more than 50 feet in straight runs of pipe. If, in the opinion of the Engineer, the foregoing requirements will result in an excessive number of labels or arrows on a run of pipe, the number required can be reduced.

Metal Tags: Where the outside diameter of pipe or pipe covering is 5/8 inch or smaller, metal tags shall be provided instead of lettering. Tags shall have the specified identifying lettering stamped in, and shall be fastened to the pipe with suitable chains. Metal tags and chains shall be aluminum or stainless steel. Where tags are used, pipe shall be color coded as specified.

Lettering: Lettering on piping shall be painted, stenciled, or snap-on markers. Snap-on markers shall be plastic sleeves as manufactured by Brady “Brady snap-on B-915,” Seton “Setmark,” or equal. Letter sizes shall be as follows:

<u>Outside Diameter of Pipe or Covering</u>	<u>Minimum Height of Letters</u>
5/8 inch and smaller	Metal tags - 1/4 inch
3/4 inch through 4 inch	3/4 inch
5 inch and larger	2 inches

Color Coding and Lettering Schedule: All piping for the following services shall be color coded and identified using the process names given below. Pipes, valves, and fittings shall be painted completely and pipes shall be labeled every 5 feet.

<u>Process</u>	<u>Abbreviation</u>	<u>Color of Pipe</u>	<u>Color of Letters</u>
Backwash	BW	Brown	White
Backwash Recycle	BWR	No Color	White
Drain	D	Dark Gray	White
Filter to Waste	FTW	Dark Gray	White
Finished Water	FW	Dark Blue	White
Hydraulic Control Water	HCW	No Color	White
Overflow	OF	Dark Gray	White
Raw Water	RW	Olive Green	Black
Sample	S	Same Color as Process	Same Color as Process
Sodium Hypochlorite	SHC	Yellow	Black

All exposed piping shall be color coded and lettered. Pipes not tabulated above shall be color coded and lettered as determined by the Engineer.

Electrical conduit shall be painted to match adjacent ceiling or wall surfaces as approved by the Engineer.

All valves shall be identified with a valve identification number. Contractor shall provide a computer file (Excel spreadsheet) with this information to the Engineer.

PART 3 EXECUTION

3.1 GENERAL

It is the intent of these Specifications that materials and workmanship be provided such that the highest quality job is obtained. The completed work, prior to acceptance, must be free from runs, skips, mars and any other disfiguring mark due to faulty workmanship or care of the completed work.

It is the responsibility of the Contractor to ensure that all surfaces are prepared in accordance with the written recommendations and directions of the paint manufacturer whose paint is applied.

Approval of conditions shall be obtained from the Engineer prior to applying any or all coats of paint; however, such approval shall not relieve the Contractor of their responsibility of conformance with these Specifications and conformance with the manufacturer's recommendations.

It shall be the responsibility of the Contractor to prevent settling of dust or the occurrence of other conditions detrimental to the finished quality of the job and to repair any damaged paint at no additional cost to the Owner.

Materials or equipment delivered with prime coats shall be touched up as required prior to the application of additional coating(s).

The Contractor shall apply each coating at the rate and in the manner specified by the paint manufacturer. If material has thickened or must be diluted for application by spray gun, the coating shall be built-up to the same thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of an additional coat(s) of paint. Film thickness shall be determined when dry by the Engineer with a magnetic dry film thickness gauge. The thickness gauge shall be calibrated with test shims.

Where thinning is necessary, only the products of the manufacturer furnishing the paint and for the particular purpose shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions as well as with the full knowledge and approval of the Engineer.

No paint shall be applied when the surrounding air temperature, as measured in the shade, is below 40 degrees F. No paint shall be applied when the temperature of the surface to be painted is below 35 degrees F. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog or mist or when the relative humidity exceeds 85 percent. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40 degrees F within 18 hours after the application of

the paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until conditions improve to be certain that the surfaces are dry prior to application of paint. No paint shall be applied when the ambient temperature is less than 5 percent F. above the dewpoint. Further, the day's painting shall be completed well within advance of the probable time of day when condensation will occur, in order to permit the paint film an appreciable drying time prior to the formation of moisture.

Manufacturer's recommended drying time shall be construed to mean "under normal conditions." Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times shall be necessary. The manufacturer's recommendations for recoating time intervals shall be strictly adhered to.

Adequate ventilation, which will effectively remove solvents, shall be provided for proper drying of paints on interior surfaces. A minimum of 7-consecutive calendar days at 70 degrees F following the application of the final coat on submerged surfaces shall be required before submergence. Longer periods shall be allowed prior to submergence if recommended by the paint manufacturer or if weather conditions require a longer curing time.

3.2 MIXING AND THINNING

Paint shall be thoroughly mixed each time any is withdrawn from the container. Paint containers shall be kept tightly closed except while paint is being withdrawn.

Paint shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. Only thinners approved by the paint manufacturer shall be used. In no case shall the wet film thickness of applied paint be reduced, by addition of paint thinner or otherwise, below the thickness recommended by the paint manufacturer.

3.3 SURFACE PREPARATION

A. GENERAL

Surfaces shall be dry and thoroughly cleaned of foreign materials with all defects filled or removed. All trades employed shall leave the surfaces of their work in such a condition that only minor cleaning, sanding and filling is required of the painting trade for surface preparation.

Hardware, switchplates, machined surfaces, nameplates, lighting fixtures and all other surfaces not to be painted shall be removed or otherwise

protected. Drop cloths shall be provided, where necessary, to avoid spotting of surfaces adjacent to the item being painted. Working parts of electrical equipment shall be protected from damage during surface preparation and painting operations.

Ferrous metal cleaning shall be in accordance with Steel Structures Painting Council Specifications (SSPC).

<u>Description</u>	<u>SSPC</u>
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Near-White Blast Cleaning	SP-10
Preparation of Concrete	SP-13

The words “blast cleaning” or equivalent phrases of equal intent shall be taken to refer to the applicable SSPC specification when used in the paint manufacturer’s recommendations or these Specifications.

Hand tool cleaning shall be used when power tool cleaning is not possible. Hand and power tool cleaning shall be in accordance with SSPC Specifications SP-2, SP-3 or SP-11, respectively.

The blast cleaning profile depth shall be not less than 1 mil or greater than 2 mils. In the case of equipment to which the manufacturer applies a primer coating in the shop after fabrication, the blast profile depth needs to be as noted above.

B. WOOD

The Contractor shall sandpaper smooth, then remove dust. After prime coat has dried, seal all knots, pitch and resinous sapwood. The Contractor shall putty nail holes and minor defects prior to painting.

C. FERROUS METAL, GALVANIZED METAL AND HOLLOW METAL SURFACES

The Contractor shall assure that fabrication, welding or burning is completed prior to the sandblasting operation. The Contractor shall chip or grind off flux, splatter, slag or other laminations left from welding. The Contractor shall remove all mill scale. The Contractor shall grind smooth rough welds and other sharp projections.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10, submerged surfaces and surfaces to 12 inches above highest liquid level, and areas subject to splash or spillage.

The Contractor shall commercial blast clean, in accordance with SSPC SP-6, all interior and exterior structural steel surfaces, surfaces located 12 inches above submerged areas, and surfaces located in areas not subject to splash or spillage where exposed to open bodies of liquids.

The Engineer reserves the right to accept preparation of these surfaces in accordance with SSPC SP-3 for areas not practical or possible to sandblast to SSPC SP-6 requirements.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10 surfaces, subject to heat in excess of 600 degrees F. The Contractor shall power tool or hand clean in accordance with SSPC SP-2 or SSPC SP-3. The Contractor shall apply prime coat on cleaned surfaces within 2 hours of cleaning. The Contractor shall solvent clean galvanized surfaces in accordance with SSPC SP-1.

D. EQUIPMENT

The Contractor shall sandblast the following equipment items or surfaces in accordance with applicable SSPC standards whether prime coated or not:

Shop primed surfaces, which have 2 percent or more of the primed surface damaged.

If catalyzed epoxy prime coat has been exposed to sunlight for longer than 60 days.

E. PREPARATION BY SANDBLASTING

The Contractor shall not sandblast surfaces that will be wet after blasting and before painting. The Contractor shall apply primer to sandblasted surfaces the same day that the surface is blasted and before rusting occurs. The Contractor shall reblast surfaces allowed to set overnight prior to priming or surfaces that show rust bloom.

The sand shall be clean, water washed, with controlled particle size and high silica content. The sand shall have sharp, angular surfaces and contain no clay particles or other extraneous matter.

The profile depth of sandblasted surfaces shall be not less than 1 mil or greater than 2 mils, unless required otherwise by the coating manufacturer.

Compressed air for blasting shall be free of water and oil. The Contractor shall provide accessible separators and traps, shall confine sandblast sand to the area being blasted, shall provide shields of polyethylene sheeting or other such barriers to confine sand and shall plug pipes, holes or openings before sandblasting and keep them plugged until the sandblasting operation is complete and the sand is removed.

The Contractor shall protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from sandblasting. The Contractor shall reblast surfaces not meeting the requirements of these Specifications.

3.4 APPLICATION

A. GENERAL

The Contractor shall mix and apply coatings by brush, roller or spray in accordance with the manufacturer's installation instructions. Spraying equipment shall be inspected and approved in writing by the coating manufacturer. The Contractor shall provide complete coverage's to the mil thickness specified. The thickness specified shall be dry film mil thickness. All paint systems are "to cover." In situations of discrepancy between the manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern. When color or undercoats show through, the Contractor shall apply additional coats until paint film is of uniform finish and color. The Contractor shall not apply consecutive coats until the Engineer has had an opportunity to observe and approve previous coats.

The Contractor shall apply materials under adequate illumination, shall evenly spread and flow on to provide full, smooth coverage, shall work each application of material into corners, crevices, joints and other difficult to work areas, shall avoid degradation and contamination of blasted surfaces and avoid intercoat contamination, shall clean contaminated surfaces before applying next coat and shall immediately smooth out runs or sags, or remove and recoat entire surfaces. The Contractor shall assure that preceding coats are dry before recoating, shall recoat within the time limits specified by the coating manufacturer and shall allow coated surfaces to cure prior to allowing traffic or other work to proceed.

The Contractor shall coat all aluminum surfaces in contact with dissimilar materials. All fabricated and structural steel shall have prime coat(s) applied in the shop and finish coat(s) applied in the field.

During application of either prime or finish coats, brush coat all weld seams, edges, angles, fasteners and other irregular surfaces to insure a monolithic film, pinhole free surface. Finish coats of paint shall be uniform in color and sheen without streaks, laps, runs, drips, sags or missed areas.

All submerged or intermittently submerged materials shall have surface preparation and coatings applied prior to installation unless otherwise approved by the Engineer. All pipe, pipe supports, and pipe hangers that will be painted shall have surface preparation and coatings applied prior to installation.

B. PRIME COAT INSTALLATION

The Contractor shall prime all surfaces indicated to be painted, shall touch-up damaged primer coats prior to finish coats and shall assure field-applied coatings are compatible with factory-applied coatings. If coatings are not compatible, and if approved in writing by the Engineer, the Contractor shall apply a 2-mil-thick universal barrier coat recommended by the paint manufacturer prior to applying field coats or completely remove factory coatings and reprime.

The Contractor shall prime ferrous metals bedded in concrete to a minimum of 1 inch below exposed surfaces. The Contractor shall backroll all primer coats applied to existing or new CMU block. The Contractor shall assure sandblasting operations do not result in the embedment of sand particles in paint film. The Contractor shall brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over the entire surface being coated. The Contractor shall backroll concrete, masonry, gypsum board and plaster surfaces with a roller if the primer has been spray applied.

C. FINISH SCHEDULE

All work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If the finish schedule requires wall surfaces to be painted in a particular space, the Contractor shall paint all appurtenant surfaces unless specifically noted not to be painted on the Plans. These items to be painted shall include:

1. Pipe supports, and equipment supports.
2. Insulated or wrapped piping, valves, fittings, hydrants and appurtenances except where covered by lagging.
3. Insulated or wrapped ductwork and appurtenances.
4. Conduit and appurtenances.
5. Ferrous metals.
6. Exposed woodwork.
7. Copper and brass surfaces.
8. Inside and/or outside of ferrous metal tankage.
9. New machinery and equipment except:
 - a. Electrical panels;
 - b. Switchboards;
 - c. Switchgear;
 - d. Safety switches;
 - e. Motor starter equipment;
 - f. Busways;
 - g. Raceways.

The Contractor shall paint the following surfaces in areas not considered as finished areas:

1. Insulated or wrapped piping, valves, fittings, yard or fire hydrants and appurtenances.
2. Insulated or wrapped ductwork and appurtenances.
3. Exposed wood.
4. New machinery and equipment.
5. Machinery and equipment in sumps, pits, boxes, channels, wetwells and structures.

The Contractor shall paint all exposed interior and exterior surfaces including:

1. Soffits.
2. Insulated or wrapped piping, valves, fittings, yard or fire hydrants and appurtenances except when covered by lagging.
3. Insulated or wrapped ductwork and appurtenances except when covered by lagging.
4. Conduit and appurtenances.
5. Exterior and interior surfaces of ferrous metal tankage.
6. Ferrous metals.
7. Exposed wood.
8. Plaster surfaces.
9. Concrete block to be sealed, paint interior surfaces only.

The Contractor shall not paint the following elements unless specifically noted on the Plans to be painted:

1. Stainless steel surfaces except as required to identify piping.
2. Exposed to view aluminum surfaces.

3. Galvanized metal surfaces.
4. Fiberglass surfaces except fiberglass piping and piping appurtenances.
5. FRP ductwork unless gel coat color is not acceptable to the Owner.
6. Interior of pipe, ductwork, and conduits.
7. Moving parts of mechanical and electrical units.
8. Code labels and equipment identification and rating plates.
9. Piping, ductwork, or pipe conduit when enclosed between suspended ceiling and overhead slabs or located in pipe chases or surfaces to be lagged.
10. Factory-finished furniture, laboratory casework, metal toilet partitions, kitchen units, lockers, shop and storage equipment or miscellaneous items that have preapproved factory applied finishes.
11. Prefaced masonry, burnished masonry units, or glass masonry.
12. Structural steel or steel deck required to be fireproofed.
13. Contact surfaces of friction-type connections.
14. Pipe and/or duct lagging.

3.5 FIELD QUALITY CONTROL

The Contractor shall be responsible for performing, testing and assuring conformance with all requirements of these Specifications.

The Contractor shall maintain daily records showing:

- Start date of work in each area.
- Date of application for each following coat.
- Moisture content and surface temperature of substrate. Also record weather conditions, ambient air temperature and dew point.

- Provisions utilized to maintain temperature and humidity of work area within paint manufacturer's recommended ranges.

The Contractor shall measure the surface temperature of items to be painted with surface temperature gauges specifically designed for such use. The Contractor shall measure substrate humidity with humidity gauges specifically designed for such use. The Contractor shall measure wet paint with wet film thickness gauges. The Contractor shall measure paint dry film thickness with a Mikrotest gauge calibrated against the National Bureau of Standards "Certified Coating Thickness Calibration Standards." The Engineer may direct measurement of paint thickness at any time during the project to ensure conformance with these Specifications. A sufficient number of dry film thickness measurements shall be made so that there is approximately one measurement for each 100 square feet of surface area painted.

Where a wall or ceiling or other type of surface is disturbed and patched, the Contractor shall repaint entire wall or ceiling. The Contractor shall provide wet paint signs as necessary. The Contractor shall touch up damaged finish coats using the same material as specified for the finish coat.

At the conclusion of all painting activities, Contractor shall submit a painting field test report to the Engineer showing the above information plus results of wet film and dry film thickness tests. Provide four copies of final test report.

3.6 PAINTING SITE

Either shop painting or field painting and surface preparation shall be acceptable when painting work is performed in conformance with this Section, unless the painting is activity specified elsewhere in these Specifications.

3.7 PAINT THICKNESS

All paint thicknesses specified herein are minimum dry film thickness (MDFT). The thickness of paint over metallic surfaces shall be measured with a magnetic thickness gauge; paint thickness over wood or masonry shall vary in accordance with surface texture, but in no case shall the manufacturer's recommended coverage rate be exceeded. The minimum thicknesses given are total coating thickness for the coating specified, including multiple coats of the same material, where applicable.

***** END OF SECTION *****

DIVISION 11
EQUIPMENT

SECTION 11000

EQUIPMENT GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

The provisions of this Section apply to all Sections of Divisions 11, 13, 15, and 16, unless specifically revised therein.

The Contractor shall direct the attention of all subcontractors and suppliers of equipment and related appurtenances for the work to the applicable provisions in the Contract Provisions wherever they may occur.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01600	Materials and Equipment
01800	Testing, Commissioning and Training
03300	Cast-in-Place Concrete
09900	Painting
11010	Vibration and Critical Speed Limitations
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

1.3 STANDARDS FOR THE WORK

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. If a specific 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.

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 operation; 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

D. DESIGN CALCULATIONS

Seismic design calculations shall be submitted for equipment and for supports and anchorage for equipment.

Special seismic certification shall be submitted for all active mechanical and electrical equipment that must remain operable following an earthquake in compliance with ASCE 7-16 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components.

E. FACTORY TEST REPORTS

Factory tests shall be performed for each piece of equipment where specifically called for in the Section specifying that equipment. Note that factory tests are inherent in many reference standards. The requirement for a factory test in a referenced standard shall make that requirement a part of these Specifications. Conduct factory tests at the same speeds at which the equipment will operate in the field except as noted.

Where specifically noted, the Engineer may witness performance test. The Contractor shall inform the Engineer in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, certified results shall be supplied by the Contractor to the Engineer.

Factory testing of pumps shall be done in accordance with the requirements and standards of the Hydraulic Institute. Tests of other equipment shall conform to the requirements set forth in these Specifications.

F. IDENTIFICATION OF DELIVERED EQUIPMENT

Each piece of equipment delivered to the project site shall be accompanied by a completed form which will contain at least the following information:

1. Owner's name and location of project.
2. Contractor's name and subcontractor if applicable.
3. Name of item being submitted.
4. Specification reference by section, paragraph and page.

PART 2 PRODUCTS

2.1 DESIGN

All equipment shall be designed for the service intended, 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. Appearance, safety, and utility shall be given consideration in the design of equipment. Materials of construction shall be cathodically compatible.

2.2 STANDARD REQUIREMENTS

A. MATERIALS

Design, fabricate and assemble equipment and systems with new materials and in accordance with acceptable engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field. Make like parts of duplicate units interchangeable. Do not place equipment in service at any time prior to delivery except as required for factory or shop tests.

B. UNIFORMITY

Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

C. SEISMIC REQUIREMENTS

Supports and anchorage of equipment(s) shall comply with the requirements of the 2018 *International Building Code* (IBC) Section 1613 and ASCE 7-16 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components, as referenced and amended by the IBC. For the following design parameters:

- Risk Category IV
- Site Class C
- The component Importance Factor: $I_p = 1.5$
- Design response acceleration coefficients:

$$S_{DS} = 1.204g$$

$$S_{D1} = 0.541g$$

- Seismic Design Category D

D. STANDARDS

Provide equipment and materials suitable for service conditions and meeting standard requirements of ANSI, ASME, AWWA, ASTM, NEMA, IBC, NPC, UL and OSHA.

2.3 LUBRICATION

Provide lubricants of types recommended by equipment manufacturers, in quantities sufficient for a minimum of 1-year's consumption prior to completion, testing and final acceptance.

2.4 EQUIPMENT BASES AND BEDPLATES

Mount equipment assemblies on a single heavy cast iron or welded steel bedplate on a grout or concrete base unless otherwise shown or specified. Provide bases and bedplates with machined support pads, vibration pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Corners shall be rounded or chamfered and ground smooth. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide leveling screws in equipment bases and bedplates to aid in leveling prior to grouting.

2.5 ANCHORS AND FASTENERS

Each equipment manufacturer shall furnish the required anchor bolts, nuts and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1-1/2 inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified. The manufacturer shall submit to the Engineer design calculations regarding recommended sizing and type of anchor bolts, nuts, and washers for securing the equipment, in accordance with the project seismic requirements.

Anchor and assembly bolts and nuts shall be of ample size and strength for the purpose intended. All nuts, bolts and washers shall be Type 316 stainless steel. All leveling nuts shall be Type 316 stainless steel.

All motor-driven equipment shall be furnished with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Do not provide expansion type anchors for motor-driven equipment, or equipment or piping subject to vibration.

Expansion type anchors are not to be used for any submerged applications unless specifically noted on the Plans.

Anchor all non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Plans, expansion type anchors may be used.

2.6 SAFETY GUARDS

Cover belt or chain drives, fan blades, couplings, exposed shafts and other moving or rotating parts on all sides with safety guards conforming to all applicable Federal, State, and local codes and regulations; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners, all hot-dip galvanized. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically, guards shall be expanded metal on a structural steel frame except that outdoor guards may be of solid material. Provide spring loaded hinged doors with latch for service and lubrication access.

All pipes, manifolds, heaters, and other surfaces, which have a surface temperature sufficient to burn human tissue, shall be covered with a thermal insulating material or otherwise guarded against contact.

Guards shall comply with the requirements of these Specifications, WISHA Standards, and “The Principles and Techniques of Mechanical Guarding” (OSHA 2057, 1973), whichever is more stringent.

2.7 LIFTING EYES

All equipment weighing over 100 pounds shall be supplied with lifting eyes. Parts of equipment assemblies, which are normally serviced separately, such as motors, shall have individual lifting eyes.

2.8 ELECTRICAL COMPONENTS

Equipment shall be manufactured, fabricated and installed in a manner which permits conduit connection to electrical power and control equipment from below the connection point, terminal box, or connection box without offsets or bends such that the conduit will drain away from the equipment.

Electric motors, control panels, accessories, etc., shall conform to the requirements of Divisions 11, 12, 13, 14, 15 (Equipment items) and Division 16, Electrical.

2.16 PUMP SEAL WATER

The Plans show a seal water system applicable to some pump installations. The Contractor shall review each pump installation with the pump manufacturer and shall provide seal water installations in strict accordance with the manufacturer's recommendations at no additional cost to the Owner.

PART 3 EXECUTION

3.1 INSPECTION

Inspect each item of equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for new equipment installation.

3.2 PREPARATION

Prior to installing equipment, ensure that the areas are clean and that concrete or masonry operations are completed. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service the equipment in accordance with the Operation and Maintenance Instruction Manuals and specific requirements included in applicable Sections of these Specifications.

3.3 SPARE AND LOOSE PARTS

Prior to equipment startup provide an inventory of spare and loose parts supplied under the project. Turn over inventory and parts to the Owner. The Owner's written acknowledgment of receipt is required for project completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment.

3.4 INSTALLATION

A. EQUIPMENT

Equipment shall conform to the approved submittals and Operation and Maintenance Instruction Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects.

B. ANCHOR BOLTS

Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed. Prior to assembly, the Contractor shall coat all stainless steel bolts and nut threads with anti-seizing compound.

C. BASE AND BEDPLATE GROUTING

Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Bevel exposed grout at 45-degree angle, except around exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth, dense finish and damp cure with burlap for 3 consecutive days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and level, and perform corrective work as required to conform to the tolerances given in the applicable Operation and Maintenance Instruction Manual.

The Contractor shall make an allowance of at least 1-1/2 inches for grout under the equipment bases, whether or not shown on the Plans. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the complete work. Unless otherwise authorized, all grout shall be a non-shrink, non-metallic grout as stated in Section 03300.

Where practicable, the grout shall be placed through the grout holes in the equipment base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

D. PRESSURE GAUGES

Pressure gauges shall be installed on all pump discharge piping at a location where the gauges can be easily read. The gauges shall be located upstream of the isolation valves, if possible. Gauges shall be installed on other equipment items as specified. The gauges are specified in Division 13 and shall be installed as detailed on the Plans.

3.5 EQUIPMENT STARTUP AND ADJUSTMENT

The Contractor, at their own expense, shall arrange for an authorized factory-trained representative of the company or companies supplying the various items of equipment to:

- Supervise the equipment installation in accordance with the Operation and Maintenance Instruction Manual.
- Be present when the equipment is first put into operation.
- Inspect, check, adjust as necessary, and approve the installation.
- Repeat the inspection, check and adjust until all trouble or defects are corrected and the equipment installation and operation are acceptable.
- Witness and supervise operational demonstrations and system validation tests to the extent specified.
- Prepare and submit the specified Manufacturer's Affidavit.

The representative shall be experienced and knowledgeable regarding the equipment being tested.

The Contractor shall give initial lubrication to all equipment in accordance with the manufacturer's recommendations.

The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

All equipment shall be field tested and demonstrated to the Engineer that proper operation and capacity have been fully complied with. For pumps, this shall include measurement of suction and discharge pressure at the pump and measurement of pumping rate by volumetric means, or through a suitably calibrated meter for two points on the performance curve. Current draw and voltage on the motor for each phase shall be measured for each pumping rate measurement. For two-speed pumps, such tests shall be conducted at both speeds. For variable speed pumps, blowers or fans, these tests shall be conducted at minimum and maximum speeds and at the specified duty point.

The Contractor shall furnish and test equipment or measuring devices (including portable flow meters) required that are not part of the permanent installation. Tests

for variable speed pumps, blowers, and other equipment shall be performed at 60 Hz and at the initial anticipated flow or capacity levels.

The field test shall demonstrate under all conditions of operation that the equipment:

- Has not been damaged by transportation or installation.
- Has been properly installed.
- Has no mechanical defects.
- Is in proper alignment.
- Has been properly connected.
- Is free of overheating of any parts.
- Is free of vibration in excess of the limits in Section 11010.
- Is free of excessive noise.
- Is free of overloading of any parts.
- Shall operate as specified with the specified control system.
- Is free of critical speeds as specified in Section 11010.

In addition, the entire facilities shall be demonstrated to be in full operating order prior to the acceptance of the work. Should any equipment or part thereof fail to operate as intended, it shall be immediately removed and replaced, all at the Contractor's expense.

Equipment start-up and adjustment shall take place before instruction of the Owner's personnel is performed.

3.6 INSTRUCTION OF OWNER'S PERSONNEL

Conduct an instruction program for up to six operations personnel designated by the Owner in accordance with Specification Section 01800. Furnish the services of qualified instructors from the various equipment manufacturers for the duration specified in each specific Section. Include instruction covering basic system operation theory, routine maintenance and repair, and "hands on" operation of equipment.

SECTION 11010

VIBRATION AND CRITICAL SPEED LIMITATIONS

PART 1 GENERAL

1.1 SCOPE

This Section specifies vibration and critical speed limitations for rotating mechanical equipment. Individual equipment specification sections may specify more stringent requirements, which shall then govern. Field-testing and vibration measurements shall be taken on all rotating mechanical equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
11000	Equipment General Provisions

1.3 SUBMITTALS

Manufacturer's certified calculations and data showing location of critical speeds in relation to operating speeds shall be provided in accordance with Section 01300, when specified in the individual equipment specification sections.

Where equipment is driven with a motor powered with a variable-frequency drive, the Contractor shall provide information on the limits and ranges of the vibration, torsion, mechanical, thermal, and similar characteristics of the driven equipment, where such limits or ranges impact the speed, time, or ramp settings of the variable-frequency drive. These points and ranges shall be included as part of the submittal information for the driven item of equipment. The purpose of this requirement is to allow coordination of the variable-frequency drive configuration with the limitations of the driven equipment.

1.4 VIBRATION LIMITATIONS

Vibration frequencies shall span the range from 5.0 to 5,000 Hz. Where specified, measurements shall be obtained while the installed equipment is operating within the specified speed range. These measurements shall be recorded and provided to the Engineer along with the Manufacturer's Affidavits.

A. CENTRIFUGAL

1. Machines with Sleeve Bearings: Unless otherwise specified, centrifugal machines with sleeve bearing shafts shall not exhibit unfiltered Root Mean Square (RMS) readings for vibration displacement in excess of the following:

<u>Shaft speed range, rpm</u>	<u>Displacement, peak to peak, mils</u>
Up to 900	3.5
901 - 1800	3.0
1801 - 3000	2.5
3001 - 4500	2.0
Above 4500	1.6

Displacement measurements shall be taken radially on the shaft at two points at each bearing. Measuring points shall be 90 degrees apart.

2. Machines with Antifriction Bearings: Unless otherwise specified, centrifugal machines with antifriction bearing shafts shall not exhibit unfiltered RMS readings for vibration velocity in excess of 0.12 inches per second. Velocity measurements shall be taken on one point of each bearing housing.

B. POSITIVE DISPLACEMENT MACHINES

Unless otherwise specified, positive displacement machines of the rotary, reciprocating and controlled volume types shall operate without any lateral or torsional vibration characteristics that may accelerate wear of the equipment. The Contractor shall provide manufacturer's certification that the manufacturer has inspected the machine under operating conditions and found it to comply with the requirements of this paragraph.

1.5 CRITICAL SPEED REQUIREMENTS

Unless otherwise specified, rotating mechanical equipment shall not exhibit critical speeds within the specified range of operating speeds. Critical speeds for equipment with rigid rotor systems shall be at least 20 percent greater than maximum operating speed or impeller blade pass frequency, whichever is greater. Critical speeds for equipment with flexible shaft-rotor systems shall be at least 15 percent below minimum operating speed and 20 percent above maximum operating speed or impeller blade pass frequency, whichever is greater.

***** END OF SECTION *****

SECTION 11210

MULTI-STAGE CENTRIFUGAL BOOSTER PUMP

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing multi-stage centrifugal booster pumps as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
09900	Painting
11000	Equipment General Provisions
11010	Vibration and Critical Speed Limitations
13422	Pressure Gauges
15050	Process Piping Systems
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Backwash Recycle Pump 1 – 1/2 hp	02 BWRP 01
Booster Pump 1 – 15 hp	02 BP 01
Booster Pump 2 – 15 hp	02 BP 02
Booster Pump 3 – 30 hp	02 BP 03

1.4 PERFORMANCE REQUIREMENTS

The multi-stage centrifugal booster pumps shall meet the following performance requirements.

Parameter	Specification
02 BWRP 01	
Shut Off (0 gpm)	67 ft
Design Operating Point (6 gpm)	60 ft
Secondary Operating Point (8 gpm)	52 ft

Parameter	Specification
02 BP 01 and 02 BP 02 (at 100 Percent)	
Shut Off (0 gpm)	275 ft
Design Operating Point (60 gpm)	270 ft
Secondary Operating Point (140 gpm)	222 ft
02 BP 03 (at 100 Percent)	
Shut Off (0 gpm)	280 ft
Design Operating Point (300 gpm)	270 ft
Secondary Operating Point (500 gpm)	215 ft

1.5 DELIVERY, HANDLING, AND STORAGE

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide a warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

02 BWRP 01 multi stage centrifugal booster pumps shall be Grundfos Model CR 1-3.

02 BP 01 ad 02 BP 02 multi-stage centrifugal booster pumps shall be Grundfos model CR 32-3 or approved equal.

02 BP 03 multi-stage centrifugal booster pumps shall be Grundfos model CR 95-2 or approved equal.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Grundfos. Any modifications to the mechanical,

structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

2.2 PUMP MATERIALS

Pumps shall be constructed of the following materials:

Item	Material Description		
	02 BWRP 01	02 BP 01 and 02 BP 02	02 BP 03
Suction/Discharge Base, Pump Head, Motor Stool	Cast Iron, ASTM A48-30B	Cast Iron, ASTM 80-55-06	Ductile Cast Iron, ASTM 65-45-12
Flange Rings	N/A	Ductile iron, ASTM 65-45-12	N/A
Shaft	Stainless steel, AISI 316	Stainless steel, AISI 431	Stainless steel, AISI 431
Impellers, Diffuser Chambers, Outer Sleeve	Stainless steel, AISI 304	Stainless steel, AISI 304	Stainless steel, AISI 304
Impeller Wear Rings	N/A	Stainless steel, AISI 304	N/A
Intermediate Bearing Ring	N/A	N/A	Tungsten carbide
Chamber Bushings	N/A	Graphite Filled PTFE	Graphite Filled PTFE
O-Rings	EPDM or FKM	EPDM	EPDM
Thrust Handling Device	N/A	N/A	316SS/silicon carbide/tungsten carbide

2.3 MOTOR

A. APPROVED MANUFACTURERS

Motors shall be by Baldor, US Motors, Reliance, Flygt, or Toshiba/Houston. No other manufacturers shall be accepted.

B. MOTOR PERFORMANCE CHARACTERISTICS

Parameter	Specification
[02 BWMTR 01] for Backwash Recycle Pump 1	
Motor Size	1/3 hp
Operating Voltage	208-230/460 V
Phase	3
Frequency	60 Hz
Synchronous Speed	3,450 rpm
Inverter Duty?	No
Motor Overtemperature Protection?	No
[02 MTR 01] for Pump 1 and [02 MTR 02] for Pump 2	
Motor Size	15 hp
Operating Voltage	208-230/460 V
Phase	3
Frequency	60 Hz
Synchronous Speed	3,444 rpm
Inverter Duty?	Yes
Motor Overtemperature Protection?	Yes
[02 MTR 03] for Pump 3	
Motor Size	30 hp
Operating Voltage	208-230/460 V
Phase	3
Frequency	60 Hz
Synchronous Speed	3,522 rpm
Inverter Duty?	Yes
Motor Overtemperature Protection?	Yes

C. GENERAL MOTOR REQUIREMENTS

The motors shall be standard horizontal, TEFC premium efficiency, electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motors shall be constructed with Class H insulated windings, Class B 30,000 anti-friction bearings, cast iron frame and end bells. The motor nameplates shall be rated for continuous duty at 40 degrees C ambient temperature with a 1.15 service factor. The rotors and short-circuit rings shall be made of copper.

Motors shall meet the efficiency requirements of the currently adopted Washington State Energy Code.

Motors shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motor shall be specifically approved by the

Washington State Department of Labor and Industries for installation on the project.

Motor manufacturer shall verify that the submitted motor is suitable for use with the motor starting method shown in the Plans.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

D. MOTORS USED WITH VARIABLE FREQUENCY DRIVES

Motors being used in conjunction with variable frequency drives shall be inverter duty rated and shall meet the requirements of NEMA MG-1 Parts 30 and 31. They shall be coordinated with the thermal, electrical, and mechanical characteristics of the variable frequency drives actually supplied in accordance with Division 16, Electrical.

E. MOTOR OVERTEMPERATURE DETECTION

1. Thermal switches

Where selected, thermal switches shall be Normally Closed (NC) and shall be sized by the motor manufacturer to open 10 degrees C below the maximum allowed operating temperature for the insulation class and ambient ratings specified herein. These switches shall be internally series connected by the manufacturer with two insulated leads brought to the motor junction box for user connection. These switches shall be suitable for 120 VAC or 24 VDC control circuit applications at 5 Amps.

2.4 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

Motor overcurrent protection shall be sized by the motor manufacturer. The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc., for inclusion in the O&M manuals.

This list shall also include any additional information needed to set-up, program or adjust the variable frequency drive, or solid state drive (soft start) which serves motor driven equipment.

The Contractor shall record the size and/or settings of each motor protective device and drive configuration.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

2.5 SPARE PARTS

The Contractor shall provide the manufacturer’s recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Spare mechanical seal 1 per pump
Required seals and gaskets 1 complete set per pump

2.6 FACTORY TESTING

The equipment shall be fully tested on water at the manufacturer’s plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve.

PART 3 EXECUTION

3.1 INSTALLATION

The pumps shall be installed as shown on the Plans and in strict accordance with the manufacturer’s instructions and recommendations. The Contractor shall insure the suction and discharge lines are free from debris, metallic shavings, wire, or other unsuitable material prior to startup. The pump shall be tested at startup and voltage, current, and other significant parameters recorded. The manufacturer shall provide a formal test procedure and forms for recording data. The pumps shall be tested for correct rotation at startup.

Pump base shall be securely anchored to the concrete using stainless steel bolts.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

Each pump shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, flow capacity, discharge pressure and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the pump manufacturer shall be provided. Services shall include 2 days (two visits) onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip shall be for installation inspection, certification and testing; and one trip shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the pumps are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 11211

SUBMERSIBLE WELL PUMP

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing, installing, and testing submersible well pump and pitless unit adaptor.

The Contractor and pump manufacturer's representative shall coordinate all aspects of supplying, delivering, installing, and testing the pump and pitless unit to comply with the requirements of these Specifications as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01800	Testing, Commissioning, and Training
02500	Water Distribution - Utility
11000	Equipment General Provisions
15100	Valves
Division 16	Electrical

1.3 EQUIPMENT LIST

The following equipment shall be provided:

<u>Item</u>	<u>Equipment Number</u>
Submersible Well Pump (Well 1)	01 WP 01

1.4 DESIGN CONDITIONS

The submersible pumps covered by these Specifications shall have the motors mounted below the pump sections as herein described and further indicated on the Plans.

The submersible pump shall be capable of meeting the following performance requirements.

Parameter	Value
Maximum Pump and Motor Speed	3,450 rpm
Motor Horsepower	5 hp
Design Point 1	
Flow	40 gpm
Total Dynamic Head	155 feet
Design Point 2	
Flow	60 gpm
Total Dynamic Head	225 feet
Pump Intake Setting Depth	Approximately 255 feet BGS – verify and match existing
Shutoff head, Maximum	280 feet
Pump Discharge Pipe Size	2-inch NPT
Riser Column Size	2-inch

1.5 PUMP WARRANTY

The pump manufacturer shall warrant the unit being supplied to the Owner against defects in workmanship and material for a period of two years. The warranty shall be in printed form. The warranty period shall begin on the date of final acceptance by Owner of the pump installation.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The submersible well pump furnished for Well 1 shall be Grundfos Model 77S50-10, or approved equal.

Any modifications to the mechanical, structural, electrical, instrumentation and control, and other portions of the work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary design revisions shall be made at the Contractor's sole expense. All redesign information prepared by the Contractor shall be submitted for review prior to incorporating the redesign into the work.

2.2 FACTORY TESTING

Perform certified factory performance tests in accordance with Hydraulic Institute Standards for each pump.

Tests shall be sufficient to determine the curves for capacity, kilowatt input, water horsepower, and overall efficiencies for heads from shutoff to a point beyond the

minimum specified head for the pumping units. Sufficient test data shall be submitted to enable computation and plotting of curves for brake horsepower and pump efficiency for full range operation. A minimum of four points, including shutoff, shall be taken for each test run. One point of the four shall be taken as near as possible to the rated condition of head and discharge. One point shall be taken near the maximum capacity point of the standard curve. Discharge shall be expressed in gallons per minute on the curves.

Certified copies of the curves, showing the results of the factory shop performance and hydrostatic tests, shall be furnished to the Owner for approval. Shipment of the pumping units shall not be made until the Owner has approved the test data curves.

2.3 SUBMERSIBLE WELL PUMP

The submersible pump assemblies shall be comprised of a submersible motor combined with a vertical turbine pump assembly of multi-stage configuration. The pump assembly shall be driven by the motor shaft through a coupling, with power being supplied to the motor through a submarine type cable. The cable shall be strapped to the riser column.

The pump shall be constructed of the following materials.

Parameter	Value
Diffuser Chamber	304 SS
Impeller	304 SS
Suction Interconnector	304 SS
Inlet Screen	304 SS
Straps	304 SS
Cable Guard	304 SS
Coupling	SS
Pump Shaft	SS

2.4 MOTOR

A. APPROVED MANUFACTURERS

Motors shall be by Grundfos, Baldor, US Motors, Reliance, Flygt, or Toshiba/Houston. No other manufacturers shall be accepted.

B. MOTOR PERFORMANCE CHARACTERISTICS

Parameter	Specification
[01 MTR 01], Well 1	
Motor Size	5 hp
Rated Voltage	3 x 440-460 V
Phase	3
Frequency	60 Hz
Synchronous Speed	3,450 rpm
Inverter Duty?	No
Motor Overtemperature Protection?	No
Classified Environment?	No

C. GENERAL MOTOR REQUIREMENTS

The motors shall be standard vertical, submersible IP68 premium efficiency, electric induction motors meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. Motors shall be constructed with Class F insulated windings, water lubricated bearings, cast stainless steel frame and end bells. The motor nameplates shall be rated for continuous duty at 40 degrees C ambient temperature with a 1.15 service factor. The rotors and short-circuit rings shall be made of copper.

Motors shall meet the efficiency requirements of the currently adopted Washington State Energy Code.

Motors shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motor shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

Motor manufacturer shall verify that the submitted motor is suitable for use with the motor starting method shown in the Plans.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

D. MOTORS USED WITH VARIABLE FREQUENCY DRIVES

Motors being used in conjunction with variable frequency drives shall be inverter duty rated and shall meet the requirements of NEMA MG-1 Parts 30 and 31. They shall be coordinated with the thermal, electrical,

and mechanical characteristics of the variable frequency drives actually supplied in accordance with Division 16, Electrical.

E. MOTOR SEAL LEAK DETECTION

All submersible motors shall be provided with seal leak detection.

The manufacturer shall supply a 120 VAC-powered, DIN-Rail mounted, seal leak detector, with a set of Form C contacts that transition on the sensing of a seal leak condition. The contacts shall be rated at 5 Amps (minimum) at 120 VAC or 24 VDC. The detectors shall be UL listed and shall operate from 120 volts AC. The Contractor shall be responsible for coordinating the installation and operation of these devices with the motor control center manufacturer or control panel supplier.

2.5 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

Motor overcurrent protection shall be sized by the motor manufacturer. The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc., for inclusion in the O&M manuals.

This list shall also include any additional information needed to setup, program or adjust the variable frequency drive, or solid state drive (soft start) which serves motor driven equipment.

The Contractor shall record the size and/or settings of each motor protective device and drive configuration.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

2.6 POWER CABLE

The power cable from the control panel or junction box to the motor shall be UL approved, submarine type power cable consisting of three-stranded, copper insulated conductors of proper size to carry the full load motor amperes at rated voltage or to keep voltage drop between motor and control panel below 3 percent,

whichever is larger. Each conductor shall be enclosed in an insulating watertight synthetic rubber or plastic jacket: the whole to be enclosed in an outer synthetic rubber or plastic jacket which shall be impervious to oil. The power cord shall be sealed, not only by use of a cord grip, but shall have individual conductors sealed into the cord cap assembly with an epoxy sealing compound to insure a watertight cable connection at the surface plate assembly. The power cable shall be supported on the riser column by means of cable clamps at intervals not exceeding 15 feet.

2.7 COLUMN PIPE

The column pipe shall be of schedule 40 threaded galvanized ASTM A53 grade B steel pipe. Column pipe sections shall be interchangeable and not over 10 feet in length. Column pipe assembly shall be provided with an approved locking mechanism to prevent unscrewing.

2.8 COLUMN CHECK VALVE

The column check valve shall be 2-inch Flomatic Type 80DIVFD with break off plug, or equal.

2.9 WATER LEVEL ACCESS PORT

The pump column shall be installed with two pipe conduits to allow measurement of water levels by installation of electronic devices, either permanent or portable. The conduit shall be Schedule 80 PVC quick set drop pipe, flush joint threaded pipe 10-foot long, measuring 1.66 inches OD by 1.25 inches ID. The PVC flush joint pipe shall meet ASTM Standard F 480-88A for thermoplastic well casing pipe and couplings.

PART 3 EXECUTION

3.1 INSTALLATION

Submersible pumps shall be installed as shown on the Plans and in strict accordance with pump manufacturer's instructions and recommendations. Pump base shall be installed using Type 316 stainless steel fasteners.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

Each pump shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the

Engineer. Voltage, amperage draw on each phase of power, flow capacity, discharge pressure and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing. In addition to performance parameters, the field test shall verify the following:

1. Has not been damaged by transportation or installation.
2. Has been properly installed.
3. Has no mechanical defects.
4. Is in proper alignment.
5. Has been properly connected.
6. Is free of overheating of any parts
7. Is free of all objectionable vibration
8. Is free of excessive noise
9. Is free of overloading of any parts
10. Shall operate as specified with.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the equipment manufacturer shall be provided by the Contractor. Services shall include 2 days (two visits) onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip (1 day) shall be for installation inspection, certification and testing; and one trip (1 days) shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11246

IRON AND MANGANESE OXIDATION/FILTRATION SYSTEM

PART 1 GENERAL

1.1 SCOPE

The work covered in this Section consists of furnishing all labor, materials, and equipment to furnish and install an iron and manganese oxidation/filtration system to the Project Location as specified herein.

1.2 PERFORMANCE REQUIREMENTS

The iron and manganese oxidation/filtration system shall be capable of treating up to 60 gallons per minute of raw water, and shall effectively remove iron and manganese to levels below 15 percent of the secondary MCLs for iron (0.3 mg/L) and manganese (0.05 mg/L). Particle retention shall be 20 microns and larger for particles other than iron and manganese.

The filter loading rate shall be between 6 and 9 gallons per minute per square foot of filter area and the backwash loading rate shall be a maximum of 28 gallons per minute per square foot of filter area. The iron and manganese removal shall be accomplished with a maximum 8.0 mg/L chlorine dose in the raw water and 1.0 mg/L chlorine residual in the filtered water.

Water quality for the well at the Project Location is provided below.

Parameter	May 2004	May 2013	May 2015	April 2019	October 2021
Iron (mg/l)	0.140	0.180	0.180		0.19
Manganese (mg/l)	0.140	0.120	0.100	0.120	0.106
Silica (mg/l)	-	-	-	-	10.0
Arsenic (mg/l)	0.002	0.002	-	-	-

1.3 EXPERIENCE REQUIREMENTS

The equipment supplier shall have at least 10-years experience in the design and manufacture of filtration equipment for drinking water systems, and shall submit a reference list of not less than 20 operating installations as evidence of meeting this requirement.

1.4 SUBMITTALS

Submittals shall be provided in accordance with Section 01300. Submittals shall include, but not be limited to, the following information.

A. SHOP DRAWINGS

The supplier shall submit four copies (or one copy if electronic submittals are provided) of shop drawings and installation instructions, including dimensions and weights, to the Engineer for review and approval. The shop drawings shall show the full equipment layout with all site piping connections clearly labeled and dimensioned as well as installation and anchorage designs for the skid mounted equipment. The shop drawings shall also contain electrical wiring diagrams and illustrate the points of connection required during installation.

B. Design and Operating Conditions

C. MANUFACTURER'S LITERATURE

Shall include information on the filtration system, backwash system, operational components, and filtration media.

D. DRAFT OPERATION AND MAINTENANCE INFORMATION

Shall include control and operational description.

E. Electrical Requirements

F. Material Safety Data Sheets

1.5 WARRANTY

The iron and manganese oxidation/filtration system shall be free of defects in workmanship, materials, and performance for a period of 3 years from the date of project acceptance. Materials and/or components failing within this period due to defects in workmanship, materials, performance, or design shall be replaced at no cost to the Owner.

If, during the first 90 days of operation, filtered water fails to meet water quality criteria as stated herein on three weekly tests, the manufacturer shall remove the equipment and reimburse the Owner for any payments made to the manufacturer.

Water samples from the raw water and treated water shall be tested for iron, manganese, turbidity, and free chlorine residual to verify system performance.

These tests shall be collected and executed by the Owner at a commercial

laboratory currently certified for the required analysis. All costs for sample collection and analysis shall be borne by the Owner.

The manufacturer guarantees that under actual operating conditions:

1. Iron and manganese shall be removed to 15 percent or less of the current secondary MCL of 0.3 and 0.05 mg/L, respectively;
2. Filtered water turbidity shall be less than 1.0 NTU;
3. Filtered water color shall be less than 15 standard color units;
4. The media will not be washed out of the system during the service run or backwashing period; and
5. The underdrain system, gravel, and media shall not become fouled, either with turbidity or by other particles, while operating as specified by the manufacturer.

These levels shall be attained with no more than one backwash cycle per 24 hours of filter run time under normal operating conditions.

1.6 DELIVERY, HANDLING, AND STORAGE

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment. All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion. All equipment delivered to the project location shall be stored as specified in accordance with the manufacturer's instructions.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

In order to maintain uniformity with other iron and manganese filtration equipment currently in use by the PUD, the iron and manganese oxidation/filtration system shall be as manufactured by ATEC Systems Associates. No other manufacturers shall be allowed.

Any equivalent iron and manganese oxidation/filtration system shall also be a pyrolusite filtration system contained in ASME compliant metal vessels. Any alternative system shall also require its own pilot study.

The structural, mechanical, and electrical designs for the future installation of the filtration equipment are based on the specified ATEC equipment. Any modifications to the structural, mechanical, or electrical portions of the work required to accommodate other equipment shall be made at no additional cost to the Owner. Any necessary design revisions shall be made at the Supplier's expense and all design revisions shall be submitted to the Engineer for review and approval prior to being incorporated into the work. A design layout of the Filter Building is included in the project plans.

2.2 FILTER TANKS

The normal operating pressure of the proposed system shall not exceed 150 psig. The treatment system shall consist of five, 18-inch diameter filters with 60-inch sidewalls. All materials used in the manufacture of this system shall conform to the specifications contained herein. Each filter shall contain 42 inches of media as described in Part 2.8.

The tanks shall be of electric welded pressure vessel quality low carbon steel construction rated for 150 psi working pressure and hydrostatically tested at 150 percent of the working pressure.

The tanks shall have stainless steel grooved coupling connections on the service inlet and outlet. Access into the filter tanks shall include one 11" x 15" access port in the top head and one 8-inch circular access port in lower sidewall of tank to allow for media removal and underdrain servicing.

Support for tanks shall be structural steel angle iron legs welded to the lower section of the sidewall. The filter tanks are to be skid mounted on a 4" x 6" heavy wall steel tubing frame with well forklift brackets and four crane lifting hooks. The entire assembly shall be suitable for anchoring to the concrete floor of the proposed building using stainless steel anchor bolts.

The equipment manufacturer shall provide recommendations for anchor bolts, fasteners, and all other appurtenances necessary to secure the equipment to the equipment pad. The Contractor shall furnish and install the filtration equipment using anchor bolts recommended by the equipment manufacturer to the depth and specifications provided by the Engineer.

2.3 COATINGS

Immersed steel surfaces on tanks shall be sand blasted to a near white metal surface finish per SSPC-SP10. Non-immersed steel surfaces shall be commercial blast cleaned per SSPC-SP6.

All immersion service surfaces shall be coated with a heat-cured, electrostatically applied fusion bonded epoxy. The epoxy shall be 3M ScotchKote 134, or equal, certified to ANSI/NSF Standard 61 and applied in accordance with the coating system manufacturer's recommendations, except as specified herein. Total dry film thickness (DFT) of immersion service coatings shall be a minimum of 10 mils.

The exterior finish shall be applied in a minimum of two coats. Exterior surfaces shall be coated with a 2 mil DFT coat of a rust resistant high solids polyurethane primer, Cardinal Industrial Finishes, Series 6460 or equal, and 1.5 - 2.5 mils DFT of Cardinal Industrial Finishes, Series 6400, High Solids Polyurethane, or equal.

The colors for each coating system shall be as selected by the Owner from the manufacturer's standard color palette.

2.4 INTERNAL DISTRIBUTION

The filter system shall be of the "down-flow" type with untreated water entering the top of the filter, flowing through the filter, and out the bottom of the tank.

The upper distribution system shall be baffled to evenly distribute the water over the entire filter surface area.

The lower distribution system shall be constructed with ten individual stainless steel wedge wire radial outlets with openings of not more than 0.010 of an inch. The radial arms shall be secured to a stainless steel hub-base by nipples threaded into stainless steel pipe couplings welded to the hub. Each radial arm shall have adequate outlet orifices to allow 60 gpm of water with a maximum pressure loss of 2 psig. The distribution system shall be embedded in a single layer of 3/8" x 3/4" washed gravel to support the filter bed.

2.5 MAIN OPERATING VALVE

The main operating valve on each tank shall be an industrial automatic multi-port diaphragm type, slow opening and closing, free of water hammer. The diaphragm assembly shall be fully guided on its perimeter when pressure activated from one position to another to assure a smooth reliable shut-off without sticking. There shall be no contact of dissimilar metals within the valve and no special tools shall be required to service the valve. The valve shall be actuated hydraulically. The operating valve shall be a Bermad Series 350, 3" x 3" x 3" Backwash Valve. The valve shall be capable of being operated hydraulically, with an operating pressure equal to the filter system inlet pressure and shall be NSF61 certified for use with potable water.

One operating valve shall be delivered to the Owner as a spare.

2.6 PIPE AND FITTINGS

The raw and treated water manifold and piping shall be Schedule 40 steel with a wall thickness of at least 0.25 inch.

Backwash piping shall be Schedule 40 steel with a wall thickness of at least 0.25 inch.

Immersed portions of manifolds shall be coated as listed in Part 2.3 of this Section.

All interconnecting piping and tubing for valve operators and control shall be provided by the manufacturer.

The inlet, outlet, and backwash manifolds shall have flanged connections complying with ANSI 16.1, Class 125.

Other piping not included with the filtration equipment shall be as required in Section 15050.

2.7 CONTROLS

The controller shall be an Alex-Tronix F8 Series, or equal, providing a local panel indication of backwash status and alarm.

The multi-ported pilot control valve shall be pre-connected to automatically pressure activate the operating control valve through the steps of backwash and return to service. The controller shall cycle through a backwash of each individual filter for an operator adjustable time period. The controller shall indicate the cycle of operation at all times on an LCD display.

A push button shall be provided on the controller for manual initiation of the backwash cycle. In addition, the capability for initiating backwash remotely by electrical signal shall be included.

The electrical time switch control shall be fully adjustable to initiate backwash at regular frequencies from hourly to once every 48 hours and/or for a set pressure differential.

An adjustable pressure differential switch shall also be provided to trigger backwash based on a preset difference in pressure between the filter inlet and outlet.

The controller enclosure shall be NEMA 4X rated and shall be UL listed. Electrical lockouts shall be provided to prevent more than one filter from backwashing at the same time except when the system is manually overridden.

2.8 FILTER MEDIA

The filter media shall be a granular, naturally occurring media containing a minimum of 65-percent manganese dioxide ore having both oxidizing and catalytic properties. The size of the media shall be 20 to 40 U. S. Mesh. The filter media shall be certified to ANSI/NSF Standard 61. The media shall be ATEC Systems 741-M Filter Media, or equal. Each filter will contain 42 inches of virgin filter media.

2.9 REGENERATION SYSTEM

Media regeneration shall not be required when chlorine is used as the oxidant.

2.10 ACCESSORIES

Two 3/4-inch and two 1/2-inch threaded and capped connections shall be provided on the inlet and outlet manifold to permit the installation of sample ports and to allow for the future installation of monitoring equipment.

A 1-inch threaded and capped connection shall be provided on the inlet manifold to allow for mounting an air relief valve as necessary. The outlet of each individual filter shall also be provided with a 3/4-inch threaded connection and a brass hose bib.

The system shall be provided with a backwash assembly. The backwash assembly shall include piping and appurtenances that may be used to control, assess, and regulate the filter backwash cycle. Components shall include piping, insertion style flow meter (Badger IP220SS, or equal), sight glass (Praher, or equal), and gate valve as listed in Section 15100. Pipe ends of the backwash assembly shall include ANSI B16.5 flanges. The Contractor shall furnish and install any and all necessary piping and fittings to connect the backwash assembly to the filtration equipment.

2.11 PRESSURE GAUGES

Two 2-inch glycerin filled Ashcroft pressure gauges shall be provided and installed to show filter inlet and outlet pressures. The operating range shall be 0 to 100 psi.

2.12 SPARE PARTS

The Contractor shall provide the manufacturer’s recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment, and the following spare parts items:

Main Operating Valve.....1 each

PART 3 EXECUTION

3.1 INSTALLATION

The iron and manganese filtration system shall be installed as shown on the Plans and in strict accordance with the manufacturer’s instructions and recommendations. The Contractor shall coordinate the equipment installation with all other associated equipment to insure a complete and workable installation.

3.2 ACCEPTANCE TESTING AND INSPECTION

The Engineer will notify the Supplier in writing when the installation is ready for inspection and startup. The inspection shall be performed by the manufacturer’s authorized representative in the presence of the Owner.

The manufacturer’s representative shall check the installation of the treatment equipment and make any field adjustments necessary to insure proper operation. The representative shall make proper adjustments to the backwash flow control valve and instruct the Owner’s personnel on proper backwash control during equipment startup.

The Supplier shall provide and submit to the Owner and Engineer a Manufacturer’s Affidavit certifying the equipment has been satisfactorily installed and started up.

3.3 MANUFACTURER’S REPRESENTATIVE

The services of an authorized representative of the filtration equipment manufacturer shall be provided. Services shall include 3 days (two visits) onsite for installation inspection, supervision of equipment startup, testing, and instruction of the Owner’s personnel in the operation and maintenance of the

equipment. One trip (2 days) shall be for installation inspection, certification, and testing; and one trip (1 day) shall be for startup, training, and performance testing. Instruction and training of the Owner's personnel shall not take place until startup is completed and the system is fully operational and shall be at a time and location agreed to by the Owner. The costs of these services shall be included in the bid price.

***** END OF SECTION *****

DIVISION 13
SPECIAL CONSTRUCTION

02 BRT 01 & 02 BRT 02	
Parameter	Performance Requirements
Design operating temperature (deg F)	45-85
Operable temperature range (deg F)	20 - 110
Specific gravity	1.0-1.1
Viscosity (cps)	1
Tank capacity (gallons)	2,000
Tank diameter (inches)	85
Height (inches)	101
Bottom shape	Flat
Color	Determined by Owner

1.5 QUALITY ASSURANCE

All vessels in this Specification shall be manufactured under the following minimum quality control program:

- A. The tank manufacturer shall employ an independent quality control manager with at least 10-years experience in the polyethylene storage tank industry.
- B. All steps of the tank fabrication shall be witnessed by either the quality control manager or their directly and solely supervised staff.
- C. A manufacturer's log of each tank's fabrication shall be kept that includes at a minimum:
 - 1. The start of fabrication and other production milestones.
 - 2. The production personnel who worked on the tank.
 - 3. The quantity and type of materials used for the tank construction.
 - 4. The settings used for the production equipment during fabrication.
 - 5. The visual inspection results for individual tank components before and after final assembly.
 - 6. Test results for completed tanks.
- D. The quality control manager shall have a current production schedule available for inspection that identifies the tank fabrication or storage location, current status, and expected completion date for the tank.

- E. Upon delivery to the jobsite, the tank shall be accompanied by a signed letter from the quality control manager that the tank was manufactured in accordance with these Specifications. This letter shall be accompanied with test data and with the manufacturer's log. The tank will not be accepted at the jobsite without this documentation.

1.6 DELIVERY, STORAGE, AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.7 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS AND PRODUCTS

The non-potable water storage tank shall be Poly Processing. Model No. 1002000 or approved equal.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Snyder. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

2.2 POLYETHYLENE STORAGE TANK

A. STANDARDS, SPECIFICATIONS, AND CODES

1. Tank and equipment shall be designed, fabricated, tested inspected and delivered in accordance with the latest issue of the following Standards:
 - a. ASTM (American Society for Testing and Materials) Standards
 - i. D618 Conditioning Plastics and Electrical Insulating Materials for Testing
 - ii. D638 Tensile Properties of Plastics
 - iii. D790 Flexural Properties of Unreinforced and Reinforced Plastics and
 - iv. Electrical Insulating Materials
 - v. D883 Definitions of Terms Relating to Plastics
 - vi. D1505 Density of Plastics by the Density-Gradient Technique
 - vii. D1525 Test Method for Vicat Softening Temperature of Plastics
 - viii. D1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics
 - ix. D1998 Standard Specification for Polyethylene Upright Storage Tanks
 - x. D2837 Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
 - xi. D3892 Practice for Packaging/Packing of Plastics
 - xii. F412 Definitions of Terms Relating to Plastic Piping Systems

- b. ARM (Association of Rotational Molders) Standards
Low Temperature Impact Resistance (Falling Dart Test Procedure)
- c. ANSI Standards
B-16.5 Pipe Flanges and Flanged Fittings
- d. OSHA Standards
29 CFR 1910.106 Occupational Safety and Health Administration, Flammable and Combustible Liquids

B. SERVICE CONDITIONS

1. Design Conditions

- a. Tanks, fabricated to this Specification, shall operate at temperatures less than 150 degrees F and shall be suitable for atmospheric pressure only.
- b. All tanks shall be fully vented to atmosphere.
- c. Tank will include the following parameter and shall be designed to withstand all stated conditions.
 - i. Design Temperature: 150 degrees F.
 - ii. Operating Pressure: Atmospheric.
 - iii. Chemical Composition of Fluids: Filter Backwash
 - iv. Specific Gravity: 1.00 – 1.1
 - v. Viscosity: 1 cps
 - vi. Ambient Temperature: 20 to 110 degrees F.
 - vii. External Loads: 20 psf plus live load and dead load.
 - viii. Bottom: Flat.
 - ix. Location: Outdoor

- x. Color: Determined by Owner. Submit color samples for review and selection.
- xi. Manway: 24-inch, non-vented, threaded.
- xii. Tank Connections:
 - (a) 4-inch overflow
 - (b) 2-inch outlet
 - (c) 4-inch inlet/outlet

C. DESIGN REQUIREMENTS

1. The minimum required wall thickness of the cylindrical shell at any fluid level shall be determined by the following equation, but shall not be less than 0.187 inches thick.

$$T = P \times O.D./2 SD = 0.433 \times S.G. \times H \times O.D./2 SD$$

T = wall thickness

SD = hydrostatic design stress (psi)

P = pressure (.433 x S.G. x H) (psi)

H = fluid head (feet)

S.G. = specific gravity (g/cm³)

O.D. = outside diameter (inches)

- a. The hydrostatic design stress shall be determined by multiplying the hydrostatic design basis, determined by ASTM D2837 using rotationally molded samples, with a service factor selected for the application. The hydrostatic design stress is 600 psi at 73 degrees F for Type I and Type II materials.
 - b. The hydrostatic design stress shall be derated for service above 100 degrees F and for mechanical loading of the tank.
 - c. The standard design specific gravity shall be 1.9.
2. The minimum required wall thickness for the cylinder straight shell must be sufficient to support its own weight in an upright position without any external support. Flat areas shall be provided

to allow locating large fittings on the cylinder straight shell.

3. The top head must be integrally molded with the cylinder shell. The minimum thickness of the top head shall be equal to the top of the straight wall.
4. Tanks with 2,000 or more gallons of capacity shall have a minimum of three lifting lugs integrally molded into the top head. The lifting lugs shall be designed to allow erection of an empty tank.
5. The tank shall be designed to provide a minimum of four tie-down lugs integrally molded into the top head. The tie-down lugs shall be designed to allow tank retention in wind and seismic loading situations without tank damage. The seismic tie down system base plates and anchor bolts shall be supplied and installed by the Contractor as recommended by the tank manufacturer per the approved structural calculations.
6. Supporting calculations for the tank seismic supports shall be supplied by the tank manufacturer. The tank and associated supports shall be designed and stamped by a structural engineer registered in the State of Washington and shall be designed for seismic loads in accordance with the following response acceleration coefficients:

$$S_{DS} = 1.204g$$

$$S_{D1} = 0.541g$$

D. EQUIPMENT

1. Like items of equipment provided hereunder although different services, shall be the end products of one manufacturer.
2. Provide anchor bolts, nuts, and anchor bolt templates for each piece of equipment furnished or specified herein, in accordance with Section 05500, Miscellaneous Metal Fabrications. Anchor bolts shall be designed to withstand all load conditions including seismic. No less than eight anchor lugs shall be provided. Details of anchors shall be shown on fabrication drawings.
3. Identify each tank with the fabricator's name, capacity in gallons, design maximum temperature, design pressure, chemical service, specific gravity, design, minimum wall thickness, tank "tag" number, tank name resin type, percent composition and date of

manufacture. Marking shall be on a 16-gauge stainless steel plate. Seal decals, labels, etc., into the laminate exterior with clear resin.

4. Lifting lugs shall be provided for all tanks weighing more than 100 pounds. Lifting lugs shall be of 316 stainless steel.
5. Tie down system components shall be 304 stainless steel.
6. All flanged nozzles on the tanks shall be rated at minimum 25 psi according to PS15-69. The flange outer diameters and drilling shall be per ANSI 16.5.
7. The back face of all flanges shall be spot-faced, flat and parallel to the flange face of sufficient diameter to accept a SAE metal washer under the bolt head or nut.
8. All tank nozzles shall be gusseted with conical type gussets in preference to plate type gussets.
9. Nozzles shall have a 6-inch projection as measured from the face of the flange to the closet point on the outside of the tank.
10. Double bolted flange fittings: Provide double bolted flange fitting outlets on all sidewall pipe connections consisting of a bolted double flange fitting. The bolted double flange fitting shall be constructed with 2 ea. 150 lb. flanges, 2 ea. 150 lb. flange gaskets, and the correct number and size of all-thread bolts for the flange specified by the flange manufacturer. The flanges shall be constructed of PVC Type I, Grade I. Gaskets shall be a minimum of 1/4-inch thickness and constructed of 40 to 50 durometer EPDM. There shall be a minimum of 4 ea. full thread bolts. The bolts will have bolt heads encapsulated in Type II polyethylene material. The encapsulated bolt shall be designed to prevent metal exposure to the liquid in the tank and prevent bolt rotation during installation. The polyethylene encapsulation shall fully cover the bolt head and a minimum of 1/4 inch of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material (white - 316 Stainless Steel). Each encapsulated bolt shall have a gasket to provide a sealing surface against the inner flange. Standard orientation of bolted double flange fittings shall have bolt holes straddling the principal centerline of the tank in accordance with ANSI/ASME B-16.5 unless otherwise specified. Bottom fittings shall be an integral part of the tank and provide complete

F. TEST METHODS

1. Test specimens shall be taken from fitting location areas or piggy-back test molds.
2. Low Temperature Impact Test
 - a. Test specimens should be conditioned at -40 degrees F for a minimum of 2 hours.
 - b. The test specimens shall be impacted in accordance with the standard testing methods as found in ASTM D1998. Test specimens < 1/2-inch thickness shall be tested at 100 ft.-lb. Test specimens > 1/2-inch thickness shall be tested at 200 ft.-lb.
3. Ultrasonic Tank Thickness Test
 - a. All tanks 2,000 gallons or larger shall be measured for tank wall thickness at 6 inches, 1 foot, 2 feet, and 3 feet on the tank sidewall height at 0° and 180° around the tank circumference with 0° being the tank manway and going counter-clockwise per ANSI standard drafting specifications. A copy of this test report shall be submitted for approval before shipment. All tanks shall meet design thickness requirements and tolerances.
4. The tank shall be visually inspected to determine such qualities as are discussed below:
 - a. The finished tank wall shall be free, as commercially practicable, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking and delaminations that will impair the serviceability of the tank. Fine bubbles are acceptable with Type II tanks to the degree in which they do not interfere with proper fusion of the resin melt.
 - b. All cut edges where openings are cut into the tanks shall be trimmed smooth.

2.3 FACTORY TESTING

A hydrostatic water test shall consist of filling the tank to brim full capacity for a minimum of 4 hours and conducting a visual inspection for leaks. A hydrostatic water test shall be conducted and a report submitted for approval before shipment.

A clearance for shipment shall not relieve the Fabricator's responsibility as to performance guarantees, quality of materials, and workmanship, and dimensional conformity with the Plans.

Engineer will be permitted access to the plant area at all times during fabrication and shall be notified 1 week prior to the estimated date of fabrication.

Repairs authorized by Engineer shall be reinspected before final acceptance unless specifically waived.

Noncompliance with this Specification or evidence of poor workmanship shall be cause for rejection.

PART 3 EXECUTION

3.1 INSTALLATION

The equipment shall be installed as shown on the Plans and in strict accordance with the Manufacturer's recommendations.

Tanks shall be prepared and provided for shipment and shipped in conformance with ASTM D3299.

Contractor shall coordinate shipment and installation of the tank connections and accessories with the tank manufacturer.

3.2 FIELD TESTING

After installation, tanks shall be hydro-tested for a period of at least 24 hours. Contractor shall provide clean water for this field test procedure.

Leaks and/or deficiencies with tanks and their ability to store the desired liquid shall be remedied by the Contractor.

3.3 MANUFACTURER'S REPRESENTATIVE

The services of a factory-trained representative of the equipment manufacturer shall be provided by the Contractor. Services for each of the unit applications shall include 3 days (two visits) onsite for the supervision of equipment startup,

SECTION 13212

CONCRETE RESERVOIR

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all materials, labor, and equipment for the construction of a concrete water storage reservoir with concrete cover and interior supports as required.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
02510	Testing and Disinfection
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete
Division 5	Metals

1.3 SUBMITTALS

Submit under provisions of Section 01300.

A. CONCRETE

For concrete products, comply with Section 03300.

B. SHOP DRAWINGS

1. Plans and/or elevations locating and defining all material furnished by manufacturer, including dimensions and finishes.
2. Sections and details showing connections, cast-in items and their relation to the structure.
3. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, etc.
4. Description of all loose, cast-in and field hardware.

C. RESERVOIR DESIGN CRITERIA

1. Loadings for Design
 - a. All dead and live loads as specified.
 - b. All other loads specified for member, where applicable.
2. Reservoir design calculations shall be performed and stamped by a structural engineer registered in the State of Washington experienced in the work under this Section.

1.4 DESIGN REQUIREMENTS

Design, fabricate, erect, inspect, and test in accordance with the 2021 International Building Code (IBC), except as modified herein.

Railings and ladders shall be designed in conformance with applicable safety and building codes, including OSHA, WISHA and the IBC.

Capacity: 89,000 U.S. gallon

Diameter: 20'- 0"

Reservoir Shell Height: 40'-0"

Minimum Wall Thickness: 15"

Vertical Loads

Dead Load: Actual

Roof Live Load: 25 psf

Snow Live Load: As required by local jurisdiction

Water Live Load: 62.4 pcf

Platform and Landings

Live Load: 150 psf

Design earthquake load in accordance with ASCE 7-16 Section 15.7.6. "Ground-Supported Storage Tanks for Liquids."

A. LATERAL FORCES

1. For wind loading conditions, the overall stability of the reservoir shall be designed to resist forces generated by the requirements for wind per ASCE 7-16.

2. Wind

Ultimate Wind Speed = 107 mph, 3-second gust

3. Seismic

Evaluate the seismic loads according to ASCE 7-16 with the following parameters:

$$S_s = 1.505g$$

$$S_1 = 0.566g$$

$$I = 1.5$$

$$S_{DS} = 1.204g$$

$$S_{D1} = 0.541g$$

B. SOIL BEARING PRESSURE

Soil bearing pressure has been determined to be 5,000 psf.

Coefficient of Friction: 0.40

1.5 QUALITY ASSURANCE

The concrete tank suppliers shall have furnished and erected at least ten similar concrete tanks within the last 5 years of at least 250,000 gallons in capacity. A letter shall be submitted by the apparent low bidder within 48 hours after the bid opening listing ten such tanks, including name of owner, capacity, location, year completed, and telephone number of owner or owner's consultant.

1.6 GUARANTEE

The Contractor shall guarantee the complete tank and all items related thereto against defective materials and workmanship for a period of 2 years after date of acceptance by the Owner. Any defective materials or workmanship shall be replaced by the Contractor, at his/her expense, immediately upon notification by the Owner.

PART 2 PRODUCTS

A. CONCRETE

All concrete products shall comply with Section 03300.

B. REINFORCING STEEL

Reinforcing steel shall comply with Section 03200.

C. WATERSTOPS

Provide waterstops in construction joints of all water containment structures and where shown on the Plans. Install waterstops to form continuous diaphragm in each joint in accordance with manufacturer's recommendations. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions and recommendations. All waterstops shall be tied into place using hog rings and/or tie wire to keep the waterstop from moving during placement of concrete. Provide manufacturer's written warranty for all waterstop installations.

D. FRAMEWORK OIL

All form oil shall be NSF61 certified.

E. ACCESSORIES

Provide the following accessories:

1. Ladders

Provide inside and outside ladders at the locations shown on the Plans. Ladders shall be hot-dip galvanized after fabrication. The ladders and landings shall be designed to be in compliance with WAC 296-24. Ladders shall be furnished with fall restraint system, Saf-T-Climb or equal. Two safety harnesses shall be provided with the fall restraint system.

2. Hand Railing

Provide hand railing on reservoir roof as shown on the Plans, and as specified in Section 05500.

3. Roof Access Hatch

Roof access hatch shall be ASTM A36 steel and hot-dip galvanized after fabrication. Access hatch shall be Halliday F1R series or equal. Hatch shall have 0.25-inch thick tread plate cover and frame extrusion, stainless -steel hardware and hold open arm, hinged lockable protection, pressure locks, and an EPDM gasket cushion on the cover and under frame perimeter

4. Roof Vent

Provide one circular removable mushroom-shaped roof vent located at the center of the reservoir, as shown on the Plans as manufactured by Newlin, Inc. (Montezuma, Indiana ((765) 245-2741) or approved equal. The vent shall be of adequate size to handle pressure differential caused by water entering or leaving the tank at a maximum rate of 1,000 gpm with 30 percent of the vent screen blocked. The open area of the overflow shall not be considered as venting area. The Contractor shall provide a special screened vent to ensure fail-safe operation, in the event the screen frosts over or is otherwise clogged. The vent shall be easily dismantled to remove the screens for cleaning. The vent shall be screened with No. 24 mesh stainless steel screen and properly attached to prevent insects, water or other contaminants from entering.

5. Overflow

Provide an overflow as shown on the Plans.

6. Pipe Connections

Provide inlet, outlet, overflow, and drain connections, as shown on the Plans.

7. Water Level Indicator

Provide a water level indicator or “telltale” with a metal indicator board painted white with black numerals marked on even foot marks with numbers arranged from “0” to “Full Water” depth or height. The numbers on the gauge board shall be approximately 6-inches high. The gauge board length shall be 1/2 the water depth. The necessary pulleys to obtain this 2:1 ratio (water depth to the indicator length) shall be located on the reservoir exterior.

The operating cable shall be enclosed pipe with pulleys. The cable shall be 5/32-inch-diameter stainless steel.

PART 3 EXECUTION

3.1 CONCRETE

All concrete products shall comply with Section 03300, except the following:

A. FINISHES

1. Surface Finishes

All finished or formed surfaces shall conform accurately to the shape, alignment, grades and sections as shown on the Plans. Surfaces shall be free from fins, bulges, ridges and offsets, honeycombing or roughness and shall present a finished continuous hard surface.

2. Wall Surfaces

Steel forms shall be used on all wall pours. Forms shall not leak excessive amounts of mortar or yield beyond specific tolerances when the concrete is vibrated. Rock pockets, honeycombed areas, form tie holes, and any holes over 1/2-inch deep shall be repaired. No sacking or hand-rubbing will be required on any concrete finishes.

Allowable tolerances for concrete surfaces shall be classified as “abrupt” and “gradual.” Offsets caused by displaced or misplaced forms and form alignment shall be considered as abrupt irregularities. All others are classed as gradual irregularities. Allowable tolerances are the same for both slabs and walls, and are as follows:

a. Abrupt - 1/2"

b. Gradual - 1"

3. Base and Roof Surfaces

All slab finishes shall have a “non-slip broom” finish, to prevent slippery surfaces. The concrete “non-slip broom” finish shall be uniform in texture, relatively free from screed/float marks, and shall comply with Section 03300. The under side of the roof shall

be a rough form finish as results from the use of plywood forms. Roof shall be a minimum slope of 1:12 after 30 days cure.

3.2 LADDERS

Install fall restraint system as shown on the Plans and in accordance with manufacturer's recommendations.

3.3 DISINFECTION AND TESTING

The reservoir shall be disinfected and tested after all interior accessories are in place. Methods and procedures for disinfecting the reservoir shall conform to AWWA C652, Disinfection of Water-Storage Facilities.

The use of chlorine solution (sodium hypochlorite) or dry chlorine (calcium hypochlorite) is anticipated as the active disinfecting agent. Contractor shall be responsible for safe and proper handling and storage of chlorine compounds or other hazardous chemical that are used to perform this work. Handling of such chemicals shall be in accordance with chemical manufacture's instructions and federal, state and local regulations. Other hazardous chemicals shall be used only after acceptance by the Engineer and Department of Health.

The intent of this section of the specifications is for the passage of bacterial and odor tests, protection of materials, health/safety and conservation of water. To achieve these requirements the Contractor shall submit written procedures and plans for disinfection of the reservoir and collecting samples to be tested by an independent laboratory. The submittal shall include:

1. Type of disinfection solution and method of preparation.
2. Method of disposal for disinfecting wastewater.

Before disinfecting, isolate the reservoir to prevent contamination of the distribution system. Remove all scaffolding, planks, tools, rags and other material not part of the structure or operating facilities of the reservoir. Clean the interior surfaces (walls, roof, beams and floor) with a pressure washer to remove dirt, oils and other foreign materials. Contractor shall be careful not to damage the structure or the new coating system in preparing the reservoir for disinfection. Disposal of water used to clean the interior of the reservoir shall be done before disinfection in accordance with applicable regulations. All water, dirt and foreign material accumulated in this cleaning operation shall be discharged from the reservoir or otherwise removed. This foreign material may be discharged out the drain piping, but shall be captured in the drainage basin and disposed to waste.

Disinfect all interior surfaces of the reservoir in accordance with the following method:

Spray or brush a solution containing 200 ppm of available chlorine onto the interior surfaces of the reservoir as prescribed in AWWA C652 Method 2. Apply solution from the bottom up and to include the entire surface area of the reservoir. Allow to remain 30 minutes or until dry before being rinsed off. Drain, dechlorinate, and dispose of all cleaning water. Fill reservoir with potable water as specified in AWWA C652.

Prior to disinfecting the reservoir, the Contractor shall schedule with the Owner to collect and analyze water samples.

After the reservoir has been cleaned, disinfected and filled with potable water, the Owner will take water samples and have them analyzed for presence/absence of total coliform and offensive odors. Sampling requirements are as follows:

1. After 48 hours a minimum of two samples shall be obtained and analyzed by standard procedures outlined by state and local regulatory agencies after at least 10,000 gallons are allowed to flush from the reservoir.
2. Sampling points shall be representative.

If satisfactory results are shown in the presence/absence test for total coliform, then the reservoir may be placed in service. If unsatisfactory results are shown in the presence/absence test for total coliform, repeated sampling and testing shall be done until two consecutive samples are satisfactory or the reservoir shall again be subjected to disinfection.

Watertightness tests shall be made at the time that the reservoir is being disinfected after the concrete has obtained at least 90 percent of its required 28-day compressive strength, but in no case sooner than 20 days after placing. Watertightness tests shall consist of filling the tank to the overflow with potable water after plugging outlets as necessary and allowing the tank to remain full for 72 hours.

Maximum allowable water surface drop after correction for evaporation shall be 0.10 inch during the final 24 hours of the test.

Leakage testing shall not be conducted during periods of time with measurable precipitation. Evaporation correction shall be made on the basis of an evaporation pan.

Watertightness testing may follow backfill of the structure, at the Contractor's option. However, if the structure does not pass the test, re-excavation to locate leaks will be required.

If a joint is not watertight after construction, the Engineer will require the repair to be by epoxy adhesive injection. Adhesive shall be Concessive 1380/Structural Concrete Bonding Process, which is a product, and process of the Adhesive Engineering Company, or equal. Epoxy adhesive injection shall be performed in strict accordance with the manufacturer's Guideline Specification. Concrete bonding and adhesives used to assure water-tightness of the structures must be listed by NSF as conforming to Standards 60/61.

The Owner will provide the water to fill the reservoir one time. Any additional water required due to failure of the disinfection or leakage tests shall be paid by the Contractor.

***** END OF SECTION *****

SECTION 13417

PRESSURE GAUGES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing new suction and discharge pressure gauges, as shown on the Plans and specified herein. Discharge pressure gauges shall include all necessary connectors and hardware on all process piping for pumps, blowers, fans, and compressors and at the various locations for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
11000	Equipment General Provisions
15050	Process Piping Systems
Division 15	Mechanical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Well Discharge	01 PG 01
Filter Skid Inlet	02 PG 01
Filter Skid Outlet	02 PG 02
Pump 1 Discharge	02 PG 03
Pump 2 Discharge	02 PG 04
Pump 3 Discharge	02 PG 05
Suction Booster Pump Header	02 PG 06
Discharge Booster Pump Header	02 PG 07
Backwash Recycle Pump Suction	02 PG 08
Backwash Recycle Pump Discharge	02 PG 09

1.4 PERFORMANCE REQUIREMENTS

Unless otherwise indicated, the discharge pressure gauge scales shall be selected so that the normal operating pressure falls between 50 and 80 percent of full scale. The suction pressure gauges on pumps, blowers, and compressors shall be equivalent to the discharge pressure gauges with a lower range of 30-inch Hg.

Pressure gauges shall be shown on the detailed installation drawings of all piping and connected equipment as specified in Section 15050. Pressure scale range for each pressure gauge shall be in the form of a summary table including all process piping pressure gauges.

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The pressure gauges shall be Ashcroft Duragage 1279, or approved equal.

The diaphragm seals shall be Ashcroft Type 101, or approved equal.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Ashcroft. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

2.2 GENERAL

The pressure gauges shall be glycerin filled type and shall have all internal parts immersed. Pressure gauges shall be minimum 4-inch dial size, with non-metallic case, stainless steel bourdon tube with plastic bushings and pinion, and stainless steel selector. Gauges shall be ANSI grade A or better with an accuracy of ± 0.5 percent.

Gauges measuring liquids shall be supplied with bronze pressure snubber and diaphragm seal. Diaphragm seals shall have silicone DC200 fluid fill and shall have a Type 316 stainless steel body, with 1/4-inch flushing connection and 1/2-inch process connection.

2.3 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

2.4 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The pressure gauges and accessories shall be installed as shown on the Plans and as specified herein and in accordance with the manufacturer's instructions.

3.3 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.4 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the pressure gauge manufacturer shall be provided. Services shall include a minimum of 1 day

onsite. Services shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance. Instruction and training of the Owner's personnel shall not take place until startup is completed and the pressure gauges are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 13419

PRESSURE TRANSMITTERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing a gauge pressure transmitter as specified herein and as shown on the Plans. The pressure transmitter shall be complete with all necessary accessories and hardware for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment number is as follows:

<u>Item</u>	<u>Equipment Number</u>
Discharge Booster Pump Header	02 APT 01
Reservoir Level	03 APT 01

1.4 PERFORMANCE REQUIREMENTS

The pressure transmitter shall be provided with the following pressure range for the specified applications and locations.

Parameter	Value
Reference Accuracy (percent of span)	0.065%
Long Term Stability (2 year max, percent)	0.1% of URL
Span Drift (percent)	None measurable
Turndown Capacity	100:1
Total Response Time	100 ms
Pressure Range	0 – 150 psig
Measurement Media	Potable Water
Maximum Media Temperature	100°F

If the manufacturer's rated maximum process temperature in the measuring cell is less than the Maximum Media Temperature listed above, the Contractor shall provide a process connection pipe/hose of sufficient length to provide ambient cooling so that the maximum measuring cell temperature is not exceeded.

1.5 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

1.6 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The pressure transmitter shall be Emerson Rosemount Model 2051T, Siemens SITRANS P DS III, or Endress and Hauser Deltabar S PMD75, with a block and bleed valve manifold provided. No other manufacturers or models shall be accepted.

2.2 PRESSURE TRANSMITTER

The pressure transmitter shall be a digital transmitter with piezoresistive or capacitance-based sensor and Type 316 stainless steel diaphragm seal. The pressure sensitive element shall be Type 316 stainless steel, silicone oil filled, and shall be calibrated for the range as specified in the Performance Requirements.

The transmitter pressure sensor shall be protected from the effects of pressure swings and spikes up to the maximum working pressure (body rating) of the pressure capsule. The process connection shall be Type 316 stainless steel, 1/2-inch diameter, NPT 14 thread. The process connection shall be connected to a Type 316 stainless steel block-and-bleed manifold with a Type 316 stainless steel isolation valve and a bleed vent. The manifold shall permit removal of the sensor for maintenance or replacement with minimal leakage of process air during compression removal of the sensor.

The transmitter shall be a true two-wire loop-powered device, 24 VDC, without the requirement of a separate power supply at the transmitter. The unit shall be modular plug-in design.

The non-wetted transmitter housing shall be aluminum or stainless steel and shall meet NEMA 4X standards. The pressure transmitters shall display the measured pressure on the front of the unit enclosure and all units shall have a menu-driven keyboard on the front panel of the transmitter. The transmitter shall have an LCD display for indicating the pressure in real engineering units (psig). The display shall be rotatable in 90 degree increments. The unit shall be capable of recalibration in the field by the menu-driven keyboard. The keyboard shall allow for viewing control of results, the error messages, the operating modes, and the digital display.

The controller shall be supplied with one isolated 0/4-20 mA standard DC (direct current) analog output; with 0.004 mA (12-bit) resolution and capability to drive up to 500 Ω loads.

The digital information shall be evaluated in the microcontroller, its linearity and temperature response corrected and converted in a digital-to-analog converter into an analog output current.

The transmitter shall have the ability to electronically compensate for the effects of mounting position on the sensor. Furthermore, the transmitter shall be able to force the loop current to various values to aid in loop setup and testing.

The transmitter shall have online diagnostics and registers to detect and store various parameters such as min/max electronics temperature, min/max pressure, capsule temperature, and min/max process pressure to help diagnose process problems. The transmitter shall also have dual timer registers that allow the transmitter to signal when a settable time has elapsed for preventative maintenance or calibration.

Analog instruments shall operate without loss of loop accuracy due to electromagnetic interference, resistive or inductive losses or similar problems related to field interconnection of components when connected with shielded copper wire in the manner shown on the Plans.

The pressure transmitters shall be listed and labeled by an electrical testing laboratory recognized by the Washington State Department of Labor and Industries or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

2.3 SPARE PARTS

The manufacturer shall provide the manufacturer's recommended spare parts and special tools. All spare parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts shall be furnished in sturdy labeled boxes.

2.4 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's factory before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The pressure transmitters shall be installed at the locations shown on the Plans in accordance with manufacturer's recommendations.

All mounting hardware and supports shall be provided by the Contractor.

If the manufacturer's rated maximum process temperature in the measuring cell is less than the Maximum Media Temperature listed in Part 1.4, the Contractor shall provide a process connection pipe/hose of sufficient length to provide ambient cooling so that the maximum measuring cell temperature is not exceeded.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the pressure transmitter manufacturer shall be provided. Services shall include a minimum of 1 day onsite. Services shall include inspection and supervision of installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance for the pressure transmitters. Instruction and training of the Owner's personnel shall not take place until startup is complete and the pressure transmitters are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 13422
FLOAT SWITCHES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing float switches and associated equipment as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01800	Testing, Commissioning and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Reservoir High Level Float Switch	03 LS 01
Reservoir Low Level Float Switch	03 LS 02
Backwash tank On/Off Float Switch	02 LS 01

1.4 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment. All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.5 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 TILTING FLOAT SWITCHES

The float switches shall be Flygt Model ENM-10 or approved equivalent equipment manufactured by Warrick Controls, Hydr-O-Matic, or Anchor Scientific.

2.2 FLOAT SWITCHES

Float switches shall be the tilting, non-mercury type. The switch shall be enclosed in a liquid-tight plastic casing with a cable of sufficient length to reach to the terminating device. Float switches shall have either single pole double throw contacts, or single pole single throw contacts. Pole and throw contact number will be determined based on recommendations of the Manufacturer as well as the application for which it will be used.

Mercury switches are not acceptable.

2.3 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The float switches shall be installed as shown on the Plans and in strict accordance with the manufacturer's recommendations. The float switches shall be mounted and positioned according to the manufacturer's approved method and at heights as directed by the Engineer (where heights are not indicated on the Plans). It shall be suspended at the proper position to hang or float, depending on the liquid level.

The electrical cable, supplied with the float, shall be connected from the float to the terminating device terminal.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall ensure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the float switch Manufacturer shall be provided. Services shall include up to 1 day onsite and shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance. Instruction and training of the Owner's personnel shall not take place until startup is completed and the float switches are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

***** END OF SECTION *****

SECTION 13451

PLC PROGRAMMING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes Programmable Logic Controller (PLC) and Operator Interface Unit (OIU) programming requirements, internal testing, witness testing, commissioning, and training responsibilities.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16910	PLC Hardware and Software

1.3 SYSTEM REQUIREMENTS

A. DESIGN REQUIREMENTS

Reference Specification 16910 for PLC hardware and software procurement.

1. The system includes programmed algorithms which run on the PLC hardware to provide a complete and functional process control system for the facility.
2. The system includes programmed screens which run on the OIU hardware to provide status, alarming, and setpoint modification for the process.

B. PERFORMANCE REQUIREMENTS

1. The installed system performs the functional and operational algorithms required for control of the process.
2. The installed system allows the operator to view process information and configure operator adjustable parameters in the PLC.

1.4 DEFINITIONS

Reference Specification Section 16050.

1.5 SUBMITTALS

- A. Submit under the provisions of Specification Section 01300.
- B. PRODUCT DATA
 - 1. Submit, at least 1 month before the start of commissioning, all proposed OIU screens including the following:
 - a. Description and pictorial of proposed screen layout(s).
 - b. Description and pictorial of graphic symbols used to represent process equipment.
 - c. Displayed operator configurable parameters and setpoints
- C. OPERATION AND MAINTENANCE MANUALS
 - 1. After acceptance of the final programmed product, provide the following:
 - a. Two electronic copies of the final annotated source code of system programming, final cross reference, and final I/O and register lists. Provide this information on two USB memory sticks.
 - i. Annotations include the following:
 - (1) Description of each rung's intended function.
 - (2) Description of each coil, contact, timer, counter, or similar function block component.
 - ii. Aliasing section where each I/O point is aliased to a logical function name. Use dot fields if available.
 - iii. Schedule of system I/O including internal register address of each I/O point
 - iv. Listing of auxiliary registers and values such as setpoints, operating parameters, control loop tuning

parameters, and similar registers or values used, including the following associated data:

- (1) Each value or parameter with its register type, register address, descriptive name, and function in the program or algorithm.
- b. Include information for obtaining assistance from the programmer.
2. Description of proposed screens including the following data:
 - a. Throughout the programming process, provide intermediate versions of the program to Engineering on request.
 - b. Include documentation detailing Operator control.

1.6 QUALITY ASSURANCE

A. QUALIFICATIONS

1. Programmer has experience successfully programming the PLCs and OIU listed in specification 16910 for a minimum of two projects of similar size and complexity. Utilize one lead PLC programmer for the entire project.

1.7 SEQUENCING AND SCHEDULING

A. INSTALLATION AND STARTUP

1. Sequence the installation and startup of the PLC program in coordination with the scheduled startup of portions of the plant. This sequencing may involve startup and operation of portions of the plant under the new control system while other portions remain in operation under the old control system. Provide for operation of the revised portions of the plant under the new control system, while maintaining operation of other parts of the facility under the old system.
2. Sequence the installation and startup of the OIU program with the PLC program sequencing.

PART 2 PRODUCTS

Provide the final complete annotated source code program on USB drive per Section 1.5.

PART 3 EXECUTION

3.1 APPLICATION

- A. Provide programming to accomplish all control and monitoring requirements indicated or specified.
- B. PROGRAM ORGANIZATION
 - 1. Organize and format the PLC programs in each processor consistently.
 - 2. Buffer all I/O in a common section of the program.
 - 3. Organize the program by Process Area.
 - 4. Organize the code sections logically within the Process Areas. Annotate each section.
 - 5. Program using ladder logic.

3.2 PROGRAM CONTROL METHODS

A. DEFINITION OF MOTOR NORMAL OPERATION

A motor is considered running “UNDER-LOADED” when it’s motor current $I_m < 5\%$ of its Full Load Amp (FLA) rating for more than 5 consecutive seconds. This is indicative of a motor disconnected from its load (broken coupling, broken shaft, etc.)

A motor is considered running in its “NORMAL” range when $5\% \leq I_m \leq 110\%$ FLA (true for motors with service factor of 1.15).

A motor is considered running “OVER-LOADED” when it’s motor current $I_m > 110\%$ FLA for more than 5 consecutive seconds (true for motors with service factor of 1.15).

3.3 PROCESS CONTROL ALGORITHM

The process control algorithm narrative is provided in the section below followed by a setpoint summary page.

A. PLC PROGRAMMING

The following algorithms and functions shall be provided in the PLC programming. A summary of all setpoints can also be found in the following section.

1. Well Pump and Chlorination

All functionality of the well pump and chlorination system will be controlled directly by the central PLC [02 CP 02].

The well pump [01 WP 01] will be called on or off when the pressure transducer in the reservoir detects the programmed “call on” or “call off” pressure setpoints, which reflect the bottom and the top elevations of the reservoir’s operational storage, respectively. These setpoints will be operator-controlled but will begin with a “call on” setpoint when the reservoir’s pressure transducers [03 PT 01] of 14 psi (32 feet of water in the tank) and “call off” setpoint of 16 psi (37 feet of water in the tank).

When the well pump [01 WP 01] is turned on, the sodium hypochlorite dosing pump’s [01 CFP 01] receptacle will also be powered on, and vice versa. This process ensures that the disinfection system is running whenever the well pump is producing water.

2. Iron and Manganese Filtration System

The iron and manganese filtration system will be controlled by the filter controller unit [02 CP 01]. Well Pump [01 WP 01] will send a run signal to the filter controller unit [02 CP 01] in order for the filter controller unit to track total run time, which will be used to trigger backwash. The filter controller unit will relay information such as status and run time to the central PLC [02 CP 02]. The central PLC will receive data directly from the backwash flow meter [02 FM 01].

Water will flow through the filtration system whenever the well pump [01 WP 01] is called on. The filter control unit will keep track of differential pressure across the filters as well as run time,

and will initiate backwash by hydraulically closing the three way valves on top of each individual filter. The filter controller [02 CP 01] will initiate backwash after a runtime length determined during commissioning. The filter controller [02 CP 01] will also initiate backwash in the event 5 psi of pressure drop occurs between the filter inlet and outlet. This pressure setpoint can be changed by the operator. The controller [02 CP 01] will also allow for the operator to manually initiate a backwash cycle at any time.

A pressure sustaining valve [02 PSV 01] will be located downstream of the filter skid and will be set to 35 psi. This setpoint can only be changed manually.

3. Backwash Recycle System

The backwash recycle system will collect, settle, decant, and recirculate backwash water back through the filter system. Two backwash tanks, plumbed in series, will fill when a backwash occurs. The backwash recycle pump [02 BWR 01] will be controlled by a single float sensor [02 LS 01]. Once the backwash water level reaches an elevation of 196 feet (5.5 feet above the slab) the float sensor will call on the backwash recycle pump.

When called on, the backwash recycle pump will draw water from the second backwash tank and pump it into the filter inlet pipe. The backwash recycle pump will only be called on when the well pump is also running. When the backwash water level reaches an elevation of 195.5 (5 feet above the slab), the same float sensor [02 LS 01] will call off the backwash recycle pump.

4. Filter-To-Waste

During commissioning, or any other time when troubleshooting is necessary, the well and filter skid can be run directly to waste. This is achieved by manually closing the butterfly valve on the tee that leads to the reservoir (located after the pressure sustaining valve) and manually opening the butterfly valve on the same tee that leads water through the building wall and outside before discharging to a catch basin. This pipe terminates in a rubber check valve with an air gap, directly above the catch basin.

The filter-to-waste process is entirely manual and does not have any associated automated process control or telemetry.

5. Finished Watertotal Chlorine Analyzer

The total chlorine analyzer will read the residual chlorine just after water leaves the filters and before the water enters the reservoir. A low chlorine residual alarm will be triggered if chlorine concentrations fall below 1.0 mg/L while a high chlorine alarm will be triggered if chlorine concentrations go above 4.0mg/L.

6. Reservoir

Once through the filter system, water will travel from inside the filtration and BPS building to the reservoir. The reservoir will be equipped with a pressure transducer [03 PT 01] which will relay pressure readings to the central PLC [02 CP 02]. The PLC [02 CP 02] will call the well pump [01 WP 01] on when the reservoir's pressure traducer relays a pressure of 14 psi (corresponding to an elevation of 220 feet) and call the well pump [01 WP 01] off at a pressure of 16 psi (corresponding to an elevation of 225 feet). The reservoir will also be equipped with both a high-level float alarm [03 LS 01] and low-level float alarm [03 LS 02]. The high-level float will be set to an elevation of 226.5 feet and the low-level float will be set to 215.0 feet. Both floats will send a signal back to the central PLC [02 CP 02] where an alarm will be triggered.

7. Booster Pump Station

Water will be conveyed from the reservoir to the distribution system and pressurized by up to three booster pumps. The two identical duty pumps [02 BP 01] and [02 BP 02] and a single high flow pump [02 BP 03]. These pumps are all be equipped with variable frequency drive (VFD) motors and are be called on and off by distribution system pressure.

Typically, the duty pumps [02 BP 01] and [02 BP 02] will operate in alternative lead-lag fashion, though they will also be capable of running simultaneously and with the high flow pump [02 BP 03], should the situation require. The central PLC [02 CP 02] will receive pressure data from the pressure traducer [02 PT 02] attached to the discharge header of the booster pumps. The PLC will call the lead pump on at 55 psi and off at 70 psi. Next, the PLC will call the lag pump on at 50 psi and off at 65 psi. Finally, the high flow pump [02 BP 03] will be called on at 25 psi and off at 50 psi. All of the pressure setpoint described above can be

adjusted by an operator at the central PLC at any time, and will likely be readjusted during the testing and commissioning period.

- B. A summary of the setpoints described in the section above is provided in the following table. All setpoints can be changed by the operator.

Setpoint Name	Initial Setting
Well Pump [01 WP 01] Call On	Reservoir pressure 14 psi [03 PT 01]
Well Pump [01 WP 01] Call Off	Reservoir pressure 16 psi [03 PT 01]
Sodium Hypochlorite [01 FP 01] Pump Call On	[01 WP 01] On
Sodium Hypochlorite Pump [01 FP 01] Call Off	[01 WP 01] OFF
Filter control Panel [02 CP 01] Initiate Filter Backwash	5 psi pressure drop or runtime determined during commissioning
Backwash Recycle Pump [02 BWR 01] Call On	BW tank water elevation of 196 feet [02 LS 01]; when [01 WP 01] is running
Backwash Recycle Pump [02 BWR 01] Call Off	BW tank water elevation of 195.5 feet [02 LS 01]
Low Residual Chlorine Alarm	Total Chlorine Concentration < 1 mg/L
High Residual Chlorine Alarm	Total Chlorine Concentration > 4.0 mg/L
Filter control Panel [02 CP 01] High Reservoir Level Alarm	Reservoir elevation 226.5 feet [03 LS 01]
Filter control Panel [02 CP 01] Low Reservoir Level Alarm	Reservoir elevation 215.0 feet [03 LS 02]
Lead pump [02 BP 01] or [02 BP 02] On	Discharge pressure 55 psi [03 PT 01]
Lead pump [02 BP 01] or [02 BP 02] Off	Discharge pressure 70 psi [03 PT 01]
Lag pump [02 BP 01] or [02 BP 02] On	Discharge pressure 50 psi [03 PT 01]
Lag pump [02 BP 01] or [02 BP 02] Off	Discharge pressure 65 psi [03 PT 01]
High Flow Pump [02 BP 03] On	Discharge pressure 25 psi [03 PT 01]
High Flow Pump [02 BP 03] Off	Discharge pressure 50 psi [03 PT 01]

C. OIU PROGRAMMING

1. GENERAL SCHEMATIC SCREEN REQUIREMENTS

The following are general guidelines for schematic OIU screens:

- a. Dynamically set the color of graphical functions per the table below.

Function	Color
Stopped	Red
Running	Green
Open	Green
Closed	Red

Function	Color
Alarm Acknowledged	Yellow
Alarm Unacknowledged	Flashing yellow

- b. Background shall be light gray; text shall be black.
- c. Pump Run Time shall be displayed in a tabular format above or below the pumps.
- d. Level – The level shall be graphically displayed on the screen, in feet, with a numeric value shown just to its left.
- e. Start Sequence Position – The starting sequence of the pumps shall be able to be set from the pump’s schematic screen. This shall be accomplished by picking a button labeled “Start Sequence Position.” The button shall be located to the left side of the first pump, adjacent to its label. The button shall open a popup screen that will allow the user to associate a pump with a function: “Lead,” “Lag1,” “Lag2” or “Lag3.” This popup screen shall include a “Cancel” and “Confirm” button. The “Cancel” button shall take the user back to the pump’s schematic screen without making any changes to the screen. The “Confirm” button shall only be accessible when each pump is associated with only one function. When the “Confirm” button is selected, the pop-up screen shall disappear and the pump’s schematic screen shall be active with the new assigned functions.

2. Event Log Screen

An event log screen shall be provided that details events and the time they occur. The event screen shall show up to 48 hours of events on each screen. The operator shall be able to scroll forward and back in time to review events. Events shall be color coded for control events, alarm events, and alarm acknowledge events.

3. Alarm Log Screen

An alarm log screen shall be provided that summarizes all alarm events. Past alarm events shall be grey. Acknowledged alarm events shall be red. Unacknowledged alarm events shall be flashing red. The operator shall be able to acknowledge all alarms or individual alarms from this screen.

The screens shall have an appearance and level of complexity similar to the example screens shown in Figures 1, 2 and 3.

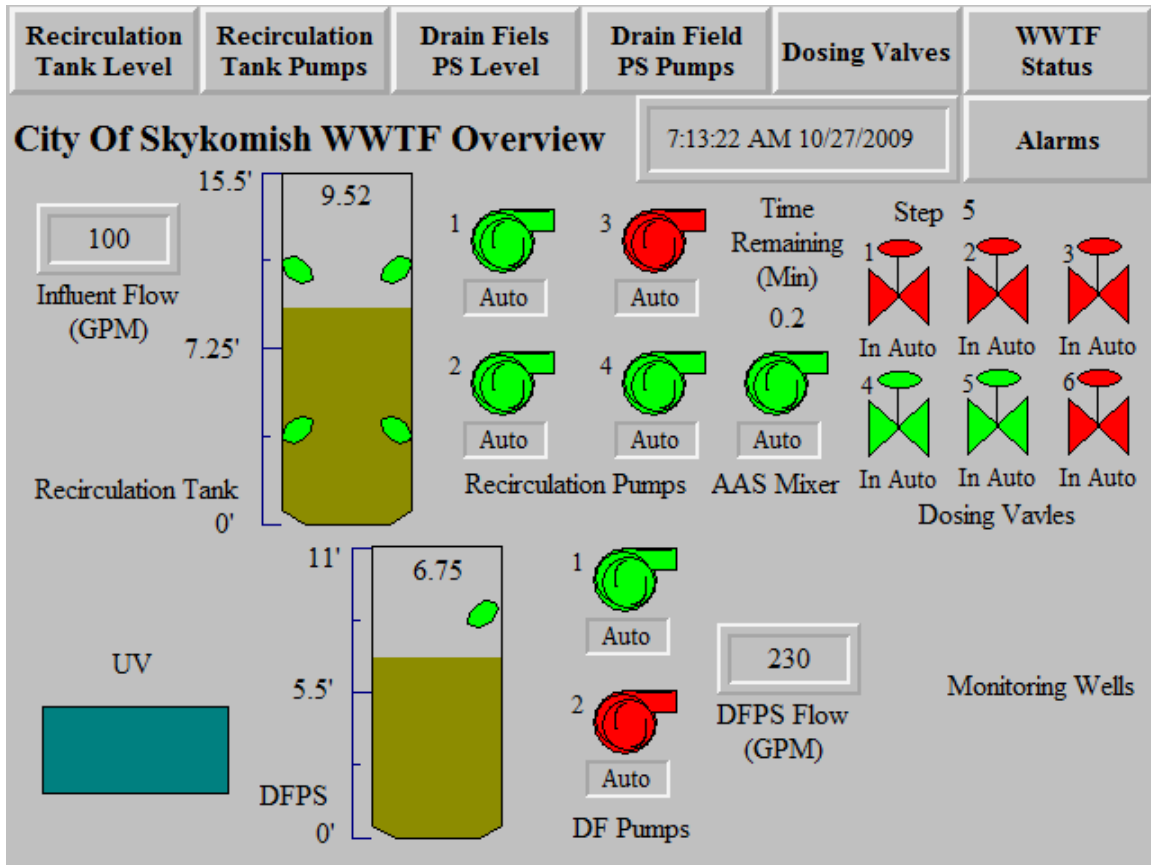


FIGURE 1

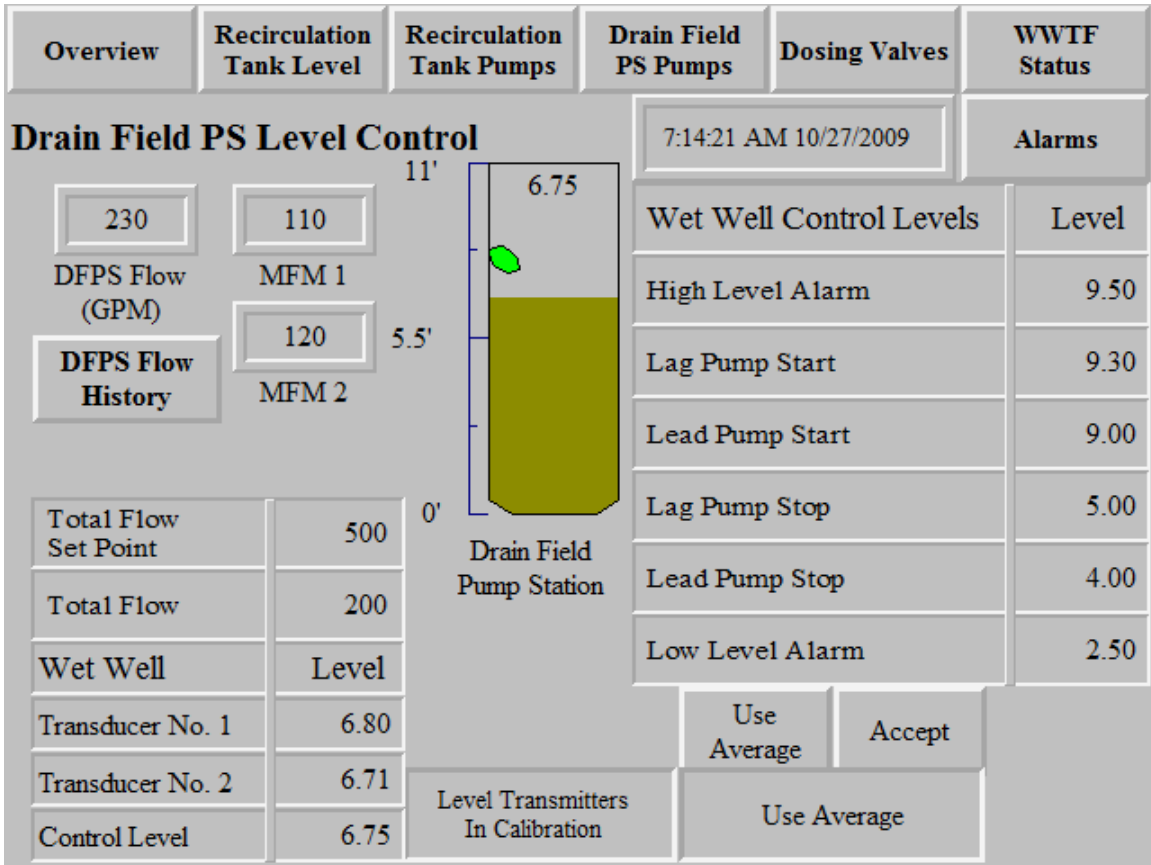


FIGURE 2

Overview	Recirculation Tank Level	Drain Field PS Level	Drain Field PS Pumps	Dosing Valves	WWTF Status
Recirculation Tank Pumps			7:14:52 AM 10/27/2009	Alarms	
Pump Status	No. 1	No. 2	No. 3	No. 4	
Rotation Position	Lag	In	In	Lead	
Pump Status	Available	Available	Available	Running	
HOA Position	Auto	Auto	Auto	Auto	
Current	12.5 A	0.0 A	0.0 A	0.0 A	
Control Power	Present	Not Present	Not Present	Not Present	
480V Power	Present	Present	Present	Present	
Circuit Breaker	Closed	Closed	Closed	Closed	
Disconnect Switch	Closed	Closed	Closed	Closed	
Overload	Not Present	Not Present	Not Present	Not Present	
Overtemperature	Not Present	Not Present	Not Present	Not Present	
Seal Leak	Not Present	Not Present	Not Present	Not Present	
Run Time (Hours)	7.2	7.2	8.3	7.4	
Number Of Starts	416	421	419	423	

FIGURE 3

3.4 SOURCE QUALITY CONTROL

A. DESIGN TESTING

1. Operate the program through all possible input paths and check for correct operation including program operation, loop controls, indications, alarm responses, and on/off sequencing control.
2. Simulate or emulate I/O conditions to verify proper operation of programming.
3. Coordinate parameter addressing, aliasing, and integrated operation with the OIU and HMI programmer.

B. SHOP TESTING

Assist in PLC shop testing if required by fab shop.

C. FIELD TESTING, PRIOR TO COMMISSIONING

Assist in PLC commissioning. Provide a PC and software during testing to allow viewing of system parameters. Verify remote communication and transfer of data. Verify proper transfer of data through all networked devices. Test and calibrate PLC scaling against actual instruments.

1. Assist in verifying all field I/O connectivity.
2. Test all analog I/O scaling and internal setpoints against actual instruments.
3. Test proper control operation of program.
4. Test PLC communication and process data and control with all networked devices (OIU, HMI, motor starters, etc.).
5. Coordinate testing with OIU and HMI programmers.

D. FIELD TESTING, DURING COMMISSIONING

Provide for programming personnel to be present on site at startup of the system(s):

1. Demonstrate PLC communication and process data and control with all networked devices (OIU, HMI, motor starters, etc.).
2. Demonstrate proper operation of the process control program, alarming functions, and setpoint input functions with the Process Engineer and the Owner.
3. Make adjustments to parameters, setpoints, and program as required to satisfy control requirements.
4. Provide Owner with a written statement that software program application has been properly started up, operates per requirements, and is ready for operation by Owner's personnel.

E. DEMONSTRATION

Demonstrate the system in accordance with Section 01800 "Testing, Commissioning, and Training."

F. ON-SITE TRAINING

1. Provide the following formal training sessions at the Owner's facility for Owner's operating and maintenance personnel by an instructor familiar with both the manufacturer's commercially available applications provided, and the specific programmed applications provided for this project, after the system has successfully completed commissioning and acceptance procedures.
 - a. Initial 2 hours of training during startup.
 - b. Provide 10 hours within 18 months after startup to provide PLC and OIU extended training and program modifications.

***** END OF SECTION *****

DIVISION 15

MECHANICAL

SECTION 15050

PIPING SYSTEMS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section describes process and utility piping, fittings, supports, and accessories shown on the Plans, described in these Specifications and as required to completely interconnect all equipment with piping for complete and operable systems.

The Contractor shall direct the attention of all subcontractors and suppliers of piping systems and related appurtenances for the work to the applicable provisions in the Contract Documents wherever they may occur.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01800	Testing, Commissioning and Training
02300	Earthwork
09900	Painting
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

1.3 STANDARDS FOR THE WORK

Pipe, fittings, 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. If a specific 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.

Piping systems and materials shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with 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. In order to meet these requirements minor deviation from the Plans may be made as approved by the Engineer.

1.4 PIPE MATERIALS

The materials to be utilized for the various pipe sizes and applications on the project shall be as follows, unless otherwise noted on the Plans or herein:

Process	Abbreviation	Inside	Outside
Backwash Water	BW	Ductile Iron, FL	Ductile Iron, MJ
Backwash Water Recycle	BWR	Solvent Welded PVC (80)	Solvent Welded PVC (80)
Floor Drain	FD	-----	Cast Iron, No Hub
Filter to Waste	FTW	Ductile Iron, FL	Ductile Iron, FL
Finished Water	FW	Ductile Iron, FL	Ductile Iron, MJ
Overflow	OF	Ductile Iron, FL	Ductile Iron, MJ
Hydraulic Control Water	HCW	Threaded/Soldered Copper (Outside Filter Skid) and HDPE (On Filter Skid)	-----
Raw Water $\leq 3"$	RW	Ductile Iron, FL	Ductile Iron, MJ
Raw Water $\geq 3"$	RW	-----	Solvent Welded PVC (80)
Reservoir Drain	RD	-----	Ductile Iron, MJ
Sample	S	Solvent Welded PVC (80)	-----
Sodium Hypochlorite	SHC	Solvent Welded PVC (80)	-----
Storm Sewer	D	-----	PVC (gravity)
Vent	V	-----	Solvent Welded PVC (80)

1.5 SUBMITTALS

Submittal data shall be supplied in accordance with Section 01300. Detailed installation drawings of all piping and connected equipment shall be submitted. The drawings shall include all piping, valves, fittings, pipe support locations and types, seismic bracing, and appurtenances.

Submit data to show that the following items conform to the Specification requirements:

- A. Pipe, fittings, and accessories.
- B. Valves.
- C. Couplings and couplers.
- D. Pipe supports and seismic braces as required herein.

Submit certified test reports as required herein and by the referenced standards.

PART 2 PRODUCTS

2.1 GENERAL

Pipe sizes are nominal inside diameter unless otherwise noted.

All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class and other appropriate data such as thickness for piping.

Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified in Part 3 Execution of this Section.

All water piping shall be certified under NSF 61 and NSF 372 for potable water use.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. GENERAL

Ductile iron pipe shall be centrifugal cast pipe conforming to AWWA C151, Class 52, unless otherwise noted, cement mortar lined in accordance with, AWWA C104. All flanged spools shall be Class 53 as shall all piping where grooved couplings are used. Approved grooved couplings may be used instead of flanged spools and fittings as approved by Engineer.

All above ground piping shall be flanged or grooved piping unless otherwise specified or indicated.

Below ground piping shall be push on joint or mechanical joints unless otherwise specified or indicated. Mechanical joints shall comply with AWWA C111.

All mechanical joints shall be restrained joints with a retainer. The restrainer shall utilize the full circumference of the pipe for restraining and utilize standard MJ gasket and bolts. The restrainer shall be Grip Ring as manufactured by Romac Industries, Mega-Lug, or equal.

All push on joints shall be restrained with field lock gaskets or TR Flex pipe from US Pipe or equal.

Flanges shall comply with ANSI B16.1, Class 125. Flange gaskets shall be full face. Approved adaptor flanges shall be used instead of flanges where shown on the Plans.

Grooved couplings shall be Victaulic Style 31, or engineer approved equal and shall comply with AWWA C606. Victaulic Style 341 adaptor flanges shall be installed instead of flanges where shown on the Plans.

Fittings shall be ductile iron and shall comply with AWWA C110 or AWWA C153, cement mortar lined, 250-psi minimum pressure. Fittings shall be mechanical joint, flanged, or grooved fittings. Fittings with grooved ends shall comply with AWWA C606 and shall be Victaulic or approved equal. Fittings shall not be "Tyton" or other push-on type joint.

The exterior of buried ductile iron pipe and fittings and pipe and fittings in contact with concrete shall be coated with bituminous coating. The exterior surface of ductile iron pipe and fittings inside of buildings, structures, and vaults shall be painted in accordance with Section 09900 of the Specifications.

All bolts not in contact with potable water shall be coated with Armite Anti-Seize Compound No. 609, or equal, prior to installation. All bolts in contact with potable water shall be coated with an NSF-61 approved anti-seize compound, SAF-T-EZE, or equal, prior to installation.

2.3 FABRICATED STEEL PIPE AND FITTINGS

Fabricated steel pipe and fittings shall be fabricated from ASTM A570 steel sheet, Grade 36 or stronger, in accordance with AWWA C200.

Minimum wall thickness shall vary in relation to pipe size (outside diameter) as shown in the following table. Where a fitting includes more than one size, then the minimum wall thickness shall be based on the largest size incorporated in the fitting.

<u>Nominal Pipe Size (inches)</u>	<u>Minimum Wall Thickness (inches)</u>
12" or smaller	0.134
18" to 42"	0.25

Fittings shall be fabricated with dimensions in accordance with AWWA C208. Flanges shall comply with AWWA C207, Class D for 12 inches and smaller pipe and Class E for pipe large than 12 inches, and be furnished with full face gaskets.

The pipe and fittings shall be coal-tar epoxy lined and tested in accordance with AWWA C210. The nominal thickness of the lining shall be 25 mils.

The exterior of the buried pipe and pipe in contact with concrete shall be coated with a minimum of 80 mils of cold-applied tape coating in accordance with AWWA C214.

2.4 PVC PIPE AND FITTINGS

A. GRAVITY

Gravity PVC sewer pipe shall be solid wall PVC pipe or approved equal. PVC sewer pipe and fittings shall conform to ASTM D3034 (15-inch and smaller) or ASTM F679 (18-inch and larger), for standard dimension ratio (SDR) 35 pipe. PVC pipe and fittings shall be furnished with integral, gasketed, bell-and-spigot, push-on type joints conforming to ASTM D3212. Elastomeric gaskets shall have a solid cross-section, be factory-installed and securely locked in place in the bell, and conform to ASTM F477. Sizes and dimensions shall be as shown on the Plans. Nominal laying lengths shall be 13 or 20 feet.

B. PRESSURE PIPE

All PVC pipe 3-inch and smaller shall be Schedule 80. Pipe shall be constructed of material that meets or exceeds ASTM D2241 and D1784 and Commercial Standard CS 256. Joints shall be solvent weld with press fit. Fittings shall conform to ASTM D2466 and D2467 for socket type and ASTM D2464 for threaded pipe.

All PVC pipe 4-inch and larger shall be PVC, Cast Iron pipe equivalent O.D., Class 235, conforming to the requirements of AWWA C900. Pipe joints shall be gasketed. Solvent-cement joints will not be acceptable. Fittings for PVC pipe 4-inch and larger shall be ductile iron, as specified in Part 2.2 of this Section.

Provisions for pipe expansion shall be as recommended by the pipe manufacturer.

Bolts for PVC pipe, where required, shall be 316 stainless steel, ASTM A193, Grade B8M, hex head with ASTM A194, Grade 8M hex nuts. Washers of the same material shall be supplied.

C. CHEMICAL FEED PIPE

All pipe for chemical feed service shall be Schedule 80 PVC pipe as described in Part B. Glue for the chemical feed piping shall meet ASTM F493 and shall be specifically formulated for chemical resistance to

hypochlorite solutions. Acceptable glue products include IPS WELD-ON 724 with P-70 primer, or approved equal.

Where chemical feed pipe joins with equipment that has threaded connections, threaded pipe joints may be used. Threaded pipe joints shall be made in accordance with the pipe manufacturer's recommendations. Pipe tape for threaded joints shall be Military Specification T-27730A tape. Pipe compound shall be used with pipe tape to make all threaded joints.

All plumbers and pipe fitters shall be trained in the ASTM B-31.3 pipe joining procedure by a representative of the PVC pipe company prior to beginning construction of the chemical feed pipe.

2.5 CAST IRON

A. BURIED

Cast iron no hub, standard weight using long pattern cast iron drainage pattern fittings and rubber ring clamp joints.

B. FITTINGS

Cast iron screwed; ANSI B16.4. Cast iron flanged; ANSI B16.1.

2.6 COPPER PIPE

Copper pipe and fittings shall be Type K (buried) or Type L or M (above ground), when used as water service lines, and Type L tube, when used as waste, vent or drainage lines.

2.7 MISCELLANEOUS FITTINGS

A. FLEXIBLE COUPLINGS

Flexible couplings shall be Romac 501 or approved equal. Middle ring and follower shall have fusion bonded epoxy coating. All buried flexible couplings shall be furnished with stainless steel bolts and nuts.

Harness lugs and tie bolts for harnessed joints on steel pipe shall comply with AWWA M-11, Third Edition and as shown on the Plans. All buried harnessed joints shall be furnished with stainless steel tie bolts and nuts.

B. FLANGED COUPLING ADAPTERS

Flanged coupling adapters shall be Rockwell (Smith-Blair) Type 912, Dresser Style 127, or equal.

C. ADAPTER FLANGES

Adapter flanges for ductile iron pipe shall be manufactured of high strength ductile iron, ASTM A536, Grade 65-45-12. Flange dimensions shall be in accordance with ANSI B16.1, 125-lb. pattern. Gasket shall be Buna-N. Setscrews shall be AISI 4140, high strength, low alloy steel. The adapter flanges shall be Uni-Flange Series 400, or equal.

D. GROOVED PIPE COUPLERS

Grooved pipe couplers for steel pipe shall consist of two ductile iron housing segments conforming to ASTM A536, pressure responsive elastomer gasket, and ASTM A449 zinc electroplated steel bolts and nuts. Couplings shall comply with ASTM F1476 “Standard Specification for the Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications.”

1. Rigid Type

Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

a. 2 Inch through 8 Inch

Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 degrees F/120 degrees C. Couplings shall be Victaulic Style 107, or approved equal.

b. Couplings shall be Victaulic Zero-Flex Style 07.

2. Flexible Type

For use in locations where vibration attenuation and stress relief are required. The couplings shall be placed in close proximity to the source of the vibration. Couplings shall be Victaulic Style 77, or approved equal.

Grooved pipe couplers for ductile iron pipe shall be Victaulic Style 31, or approved equal.

The gaskets shall be suitable for use in drinking water.

All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. DIELECTRIC INSULATED UNIONS

Dielectric insulated unions shall be used to connect dissimilar metals. They shall separate the metals so that the passage of more than one percent of the galvanic current, which would exist with metal to metal contact, is prevented. Unions shall be of the same material as the pipe to which attached, and pressure and temperature ratings shall be no lower than that of the piping system in which it is installed.

F. WALL SLEEVES AND SEALS

Wall and/or floor pipe penetrations shall be made by means of a sleeve capable of being bolted directly to the formwork to prevent misalignment. Seal of the annular space between the carrier pipe and the sleeve shall be by means of a confined rubber gasket and capable of withstanding 350 psi. Sleeve shall be manufactured from Ductile Iron with an integrally cast waterstop of 1/2-inch minimum thickness and 2-1/2-inch minimum height. Wall sleeves shall be omni*sleeve or equal.

Seals for pipe sleeves shall be bolt-up type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the sleeve. When bolts are tightened the rubber sealing elements shall expand to result in a watertight seal. Bolts and pressure plate nuts shall be Type 316 stainless steel in below grade or "wet" locations, and of carbon steel at other installations. Rubber links shall be suitable for use in water, moist environments, normal atmospheric conditions, and -40 degrees F to 250 degrees F temperatures for standard service.

G. SERVICE SADDLES

Saddles shall be single strap stainless steel, female iron pipe thread outlet, and shall be Style 101NS or 202S as manufactured by Romac Industries, Inc., or equal.

H. CORPORATION STOPS AND METER SETTERS

Corporation stops and the single meter shutoff valves shall be Mueller, Ford, or A.Y. McDonald with the type and style noted on the Plans or approved equal. Included as a part of the service connection shall be the furnishing and installation of the meter box complete with lid, set flush with the proposed finished grade of the lot in the designated location near the property line, all as shown on the Plans.

I. RETRACTABLE INJECTION QUILLS.

All injection quills shall be retractable and equipped with a check valve and corporation stop. Injection quills shall be model EB-145-S-P-2-B-E by Saf-T-Flow or approved equal. The quill shall terminate at the center line of the raw water pipe. The quill can be trimmed if necessary but should terminate at a 45 degree angle.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

A. GENERAL HANDLING AND PLACING

All piping constructed on this project shall be performed in accordance with the Uniform Plumbing Code. These Plans do not detail all items such as complete venting, etc.; however, it is understood that this work shall be included as a part of this Section and all costs included in the lump sum bid.

Pipe and accessories shall be handled in such a manner as to insure delivery on site in sound, undamaged condition. Particular care taken not to injure pipe coating. No other pipe or material of any kind shall be placed inside of lined pipe or fitting after lining has been applied. All pipe and fittings shall be unloaded, stored, handled in such a manner as to insure against damage. Dropping of pipe or fittings shall be cause for rejection.

The types and sizes of pipes to be used shall be as specified herein and as shown on the Plans. Where sizes of small pipe are omitted from the plans and not mentioned in the Specifications, the sizes to be used shall correspond to plumbing code requirements. In any event, undesignated pipe sizes shall be proper for the function to be performed and as accepted by the Engineer.

All pipe shall be carefully placed and supported at the proper lines and grades and where possible shall be sloped to permit complete drainage. Piping runs shown on the Plans shall be followed as closely as possible, except for minor adjustments to avoid architectural and structural features. If major relocations are required, they shall be approved by the Engineer.

Unions shall be installed in all threaded joint piping to facilitate the removal of sections for maintenance and repair in accordance with the best trade practice. Unions shall be ground joint, malleable iron type. Where unions connect dissimilar materials, the union shall be protected from reaction with dissimilar metals by installation of insulating materials and dielectric unions at contact points.

The interior of all piping shall be cleaned after assembly and before connecting to equipment.

All piping for which no location dimensions are shown shall be installed in a neat and workmanlike manner in accordance with best trade practice. Wherever possible runs and rises shall be grouped and kept parallel. Properly lay out all miscellaneous piping to clear obstructions such as passageways, equipment, larger sized pipes, ventilation ducts, lights, etc.

Whenever pipe requires field cutting to fit in line, work shall be done by a machine in a satisfactory manner so as to leave a smooth end at right angles to axis of pipe.

All piping to be buried below structures, foundations, or slabs shall be installed with extreme care. When all joints have been made, Contractor shall demonstrate to Engineer's satisfaction that all of piping is watertight and that all lines are clear before proceeding with any work above this piping. It shall be Contractor's responsibility to see that these lines are kept clear until final acceptance of the project, providing suitable tight wooden bulkheads or plugs for open end pipes. Any blockage of these systems due to earth, debris, cement slurry or anything else shall be rectified at Contractor's expense before project is accepted.

All pipe shall be installed in strict accordance with manufacturer's recommendations and/or specifications, and best commercial trade practice. Any special tools required for laying, jointing, cutting, etc., shall be supplied and properly used. All pipe shall be kept thoroughly clean until acceptance of completed work, and shall conform accurately to lines and grades given. At all times during pipe laying operations keep trench free of water either by pumping, bailing, or drainage. Seal end of line with a tight-fitting plug when pipe is not being laid.

Valves shall have interiors cleaned of all foreign matter and inspected, both in open and closed positions prior to installation.

All pipes running through concrete walls below water surface or where subject to groundwater pressure shall be assembled as shown on the plans. Pipes running through concrete not subject to water pressure may be installed through standard steel sleeves, one or two pipe sizes larger than pipe in question. The pipe shall be free of all dirt and grease and thoroughly cleaned to insure a tight bond with the concrete.

All above ground outside pipe carrying liquids shall be insulated.

B. GENERAL EXPOSED PIPING INSTALLATION

Unless shown otherwise, piping shall be installed parallel to building lines, plumb, and level.

Piping shall be installed without springing or forcing.

All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.

Flexible couplings shall be provided for all piping connections to motor-driven equipment and where otherwise shown in the Plans. The Contractor may install additional flexible couplings at approved location to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection.

Unions or flexible couplings shall be installed where shown on the Plans, and at all non-motor-driven equipment to facilitate removal of the equipment.

Where equipment drain connections are provided, they shall be valved, with the discharge pipe carried to the nearest floor drain, drain trench, or sump. Where no receptacle for drain exists, drain valves shall be piped to 1 inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.

All exposed or submerged piping shall be painted and color-coded in accordance with Section 09900, unless otherwise specified.

3.2 PVC PIPING

A. GENERAL

PVC piping socket weld connections shall be made up in accordance with the pipe manufacturer's recommendations and as follows:

Where pipe is cut, remove all burrs and ream inside to provide smooth flow line. Bevel the plain end pipe 1/16 inch to 1/32 inch. Joints shall be first cleaned with cleaner before making up. Apply primer to the female joint. Apply primer to the male joint. Reapply primer to the female joint. Apply glue to the male joint. Apply glue to the female joint. Reapply glue to the male joint. Join pipe quickly with a 1/4 turn. If joint cannot be made up to full depth of socket, cut out and discard. Wipe off excessive cement. Hold for 30 seconds and do not move for 15 minutes after making up joint. Pipe joining below 40 degrees F will not be permitted. Cleaner and cement types shall be as recommended by the manufacturer for the size of pipe being used.

B. DOUBLE CONTAINMENT PIPING SYSTEM

1. Installation

All installation procedures shall be according to the manufacturer's specific recommendations. The manufacturer shall furnish the services of a competent representative to supervise the Contractor's personnel during the start of installation.

Secondary containment joints shall be solvent-cemented joints using HERCULES heavy body-slow set PVC cement ASTM D-2564, made in accordance with ASTM D-2855 procedure. The splitting and re-welding of the fitting shall not be permitted. The use of hot gas welding for pressure retaining joints shall be kept to those locations where it is deemed necessary by the manufacturer.

All contractor personnel that will prepare solvent cemented joints shall be qualified for such bonding practices according to the bonding qualification procedures described in ASME B 31.3, Chapter VII for bonding of plastic piping. The bonding qualification procedure shall be that as written and provided by the manufacturer.

Following installation of the systems, the primary piping system shall be flushed clean. The Contractor shall check the operation of all valves, leak detection devices, and appurtenances.

After testing, the annual space shall be purged of moisture containing air by replacing the volume of air with clean, dry nitrogen.

2. Leak Detection

Provide and install at each zone a density sensor station consisting of an external clip-on sensor, drip leg, and drain valve with hose connection and/or riser and sensor extension handle. Each sensor shall have LED testing lamp, adjusting potentiometer and be removable for periodic testing. Sensor shall not penetrate the containment-piping jacket. Control console shall be housed in a weatherproof enclosure, operating on 120 VAC and supplies 24 VDC to zone sensors. Console shall have 10-zone capacity, alarm lamps, pilot lamp, reset buttons, test buttons, and mute switch. Console shall also have a common audible alarm and external switched output for accessory alarms. Optional automatic battery backup and timers available. The system shall be manufactured by Guardian Systems, or equal.

C. FUSIBLE PVC

Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed as described in this specification.

3.3 COPPER PIPE

All copper water service lines shall be tested, cleaned, and chlorinated, as described below. All waste, vent or drainage lines shall be flushed clean, and shall be tested by plugging the lowest point and filling the waste, vent or drainage piping with water to the level of the top of the vent pipe, but no joint in the system shall be submitted to a test of less than 10 feet of head. Under this condition, all joints shall remain watertight for a period of not less than 1 hour.

Piping shall be pressure-tested with water to a pressure of 125 psi.

3.4 FLANGED PIPING

Flanged joints shall be made in accordance with best trade practice. Screwed flanges for piping shall be run until pipe projects beyond face and no more than one thread is exposed on backside. All flange faces shall then be machined so as

to be perfectly parallel. All flanged pipe shall be accurately dimensioned; no “drawing-up” will be allowed. Gaskets shall be full face, rubber.

3.5 GROOVED JOINT PIPING

Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for Contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review Contractor is following best recommended practices in grooved product installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s)).

3.6 MECHANICAL JOINT PIPING

Mechanical joint piping shall be installed in best trade practice with torque wrenches used to avoid overstressing bolts. Piping shall be installed using recommended procedures outlined in “Handbook of Cast Iron Pipe” as published by Cast Iron Research Association which in part requires that all contact surfaces of rubber seal with pipe be wire brushed, spigot be centrally located in bell. When tightening bolts, it is essential that the gland be brought up toward pipe flange evenly, maintaining approximately same distance between gland and face of flange at all points around socket.

3.7 PIPE SUPPORTS

Provide all necessary supports, tie rods, bracing, brackets or other types of supports which may be required, as shown on the Plans, or as specified in Section 15066.

3.8 PIPE BEDDING

All pipe shall be bedded as specified in Section 02300.

3.9 TESTING

A. GENERAL

All piping shall be tested and inspected in accordance with the provisions of Division 7 APWA/WSDOT, except as modified herein. Where new piping systems are being connected to existing piping systems the existing

piping systems shall be tested prior to connecting to the new pipe to the existing piping. Once the new piping system has been connected to the existing piping system the entire system shall be tested again.

All piping systems will be tested to demonstrate leak tightness prior to acceptance. The Contractor shall provide all equipment and labor necessary to perform all testing required herein, the costs to be included in the lump sum bid price.

Each particular piping system shall be tested as hereinafter specified. All leaks shall be repaired or defective material replaced and the test repeated as directed by the Engineer. After compliance with test requirements and approval of the Engineer, the field painting, where required, may be started. All pressure testing shall be done prior to any finish painting or pipe insulating.

The Contractor shall be responsible for repair of any damage resulting from or caused by leak testing.

All thrust blocks shall be in place for at least 7 days to allow concrete to cure before testing. Install adequate blocking or other means of resisting test pressure.

B. PRESSURIZED LIQUID PIPING

All PVC, ductile iron and steel piping for pressurized liquid, shall be pressurized with water to 100 psig and remain leaktight for a period of 4 hours.

All cross connection protection equipment shall be tested by a certified inspector prior to putting the piping into service. Submit test report to Owner.

C. DISINFECTION

Piping system disinfection shall meet the requirements of section 02510.

***** END OF SECTION *****

SECTION 15066

PIPE AND CONDUIT SUPPORT SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

The work specified in this Section includes pipe and conduit hangers, brackets, and supports. Pipe and conduit support systems shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, structural attachments, and other accessories as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01600	Materials and Equipment
01800	Testing, Commissioning, and Training
09900	Painting
15050	Piping Systems
16050	Basic Electrical Materials and Methods
16130	Raceways and Boxes

1.3 REFERENCES

All pipe and conduit 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 Hangers and Supports C Selection and Application
SMACNA	Seismic Restraint Manual C Guidelines for Mechanical Systems
IPC	International Plumbing Code

1.4 SUBMITTALS

In accordance with the requirements of Section 01300, submit the following project data prepared by a licensed Professional Engineer:

- A. Manufacturer's technical data for all hangers, brackets, supports and documentation of conformance with appropriate standards and these specifications.
- B. Location of pipe and conduit support, including type of structural and pipe attachments, shown on detail drawings and/or specified under paragraph 1.5 of Section 15050.

PART 2 PRODUCTS

2.1 GENERAL

The Contractor shall design, provide, and install pipe and conduit 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. The support system shall be designed in conjunction with the pipe and conduit to be supported. Seismic restraints shall be provided in accordance with SMACNA Manual as referenced in paragraph 1.3.

In certain locations, pipe supports, anchors, and expansion joints have been indicated on the Plans, 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 and conduit supports. Pipe support schedule under paragraph 2.7 of this Section sets forth minimum requirements for pipe supports.

2.2 PIPE RACKS AND TRAPEZE HANGERS

Pipe and conduit racks and trapeze hangers shall be constructed of galvanized steel channels, rods, posts, post base, clamps, brackets, fittings, and accessories for supporting pipes in equipment and pump rooms. All components for pipe and conduit rack and trapeze shall be Unistrut or equal.

2.3 PIPE CLAMPS AND HANGERS

In areas where pipe racks and trapezes are not used, pipe shall be supported with clamp hangers and stanchion saddle 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.

All pipe clamps and hangers, including all accessories, shall be galvanized steel for indoor use and Type 316 stainless steel for outdoor use.

Pipe and conduit clamps and hangers shall be as manufactured by Anvil or equal and shall be as follows:

Type	Pipe Size (In.)	Pipe Material	Anvil Figure
Swivel Ring, Split Type	3/4 to 8	All type	104
Split Clamp	1/2 to 3	All type	138R
Adjustable Ring	1/2 to 6	All type	97
Adjustable Ring	1/2 to 4	Copper	CT-269
Adjustable Clevis	3 to 24	All type	590
Pipe Clamp	3 to 42	All type	216
Socket Clamp	4 to 24	Cast Iron	595
Pipe Stanchion	4 to 24	All Type	63
Stanchion Saddle	4 to 36	All type	259
Adjustable Saddle Support	3 to 36	All type	264
Riser Clamp	2 to 24	All type	40
Adjustable Pipe Roll	6 to 12	Stainless Steel	177, 181, or 274

2.4 STRUCTURAL ATTACHMENTS

Structural attachments shall be concrete insert channels or individual inserts for new concrete, surface-mounted channel or individual inserts for existing concrete or where applicable, steel, roof plate supported attachments in the control building, complete with all accessories required. All structural attachments including all accessories shall be galvanized steel for indoor use and stainless steel for outdoor use, and shall be provided by a single manufacturer. Structural attachments shall be as measured by Unistrut Corporation or approved equal.

2.5 PIPE SUPPORT ATTACHMENTS TO CONCRETE

All pipe support attachment to concrete shall be in adhesive anchors unless noted otherwise.

Products which may be incorporated in the work include, but are not limited to, the following:

- A. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.

- B. HIT HY 150 Injection adhesive Anchor, Hilti, Inc.
- C. Power-Fast, Powers Fasteners, Inc.

2.6 PROTECTION SADDLES

Protection saddles shall be used for protecting pipe insulation against damage at pipe supports or as shown on the Plans. The nominal thickness of covering shall be the same as that of pipe insulation. The protection saddles shall be curved carbon steel plate and shall be Anvil Figure 160 through Figure 166 or approved equal.

2.7 SPACING

Maximum support spacing shall conform to the following table:

Pipe Size Inches	Pipe Material	Maximum Spacing Feet
1" & Smaller	Iron or Steel	6
	Copper Plastic Tubing	4-1/2 continuous continuous
1-1/4 to 2"	Iron or Steel	8
	Copper or Plastic	5
2-1/2 to 4"	Iron or Steel	10
	Copper or Plastic	6
6 to 8"	Iron or Steel	12
	Plastic	8

PART 3 EXECUTION

3.1 DESIGN

Pipe and conduit support systems shall be designed in accordance with applicable reference standards specified in paragraph 1.3. Pipe and conduit supports shall be designed and selected to withstand seismic loads for IBC 2018 Seismic Design Category D with $S_s=1.505g$ and $0.556g$ and shall adhere to the following conditions:

- A. 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.
- B. 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.

- C. Wherever possible, pipe attachments for horizontal piping shall be pipe clamps, or as shown on the pipe support detail sheet. Horizontal or vertical pipes should be supported preferably at locations of least vertical movement.
- D. All pipe supports shall provide a means of vertical adjustment after erection.
- E. Where practical, riser pipe shall be supported independently of the connected horizontal piping. Pipe support attachments to the riser piping shall be riser clamps.

3.2 INSTALLATION

Pipe support system shall be installed strictly in accordance with standards and codes referenced in paragraph 1.3 of this Section and piping support system manufacturer and piping manufacturer's recommendations.

In addition, all piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports.

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, which contact other dissimilar metals, shall be rubber or vinyl coated.

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. Anchorage for bellows type expansion joints may be located adjacent to the joint.

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 Plans or specified in other sections.

*****END OF SECTION *****

SECTION 15100

VALVES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of valves and accessories as shown on the Plans, described in these Specifications, and as required to completely interconnect all equipment with piping for complete operable systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Payment
01300	Submittals
01800	Testing, Commissioning and Training
Division 11	Equipment
Division 15	Mechanical

1.3 SUBMITTALS

Submit Catalog cuts and shop drawings in accordance with Section 01300 to demonstrate that the valves and appurtenances conform to the Specifications requirements.

The Contractor shall furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for all valves.

1.4 QUALITY ASSURANCE

All materials and equipment furnished under this Section shall be by the manufacturer specified.

All materials in contact with potable water shall be NSF 61 and NSF 372 certified for potable water use.

PART 2 PRODUCTS

2.1 GATE VALVES

Gate valves 3 inches and smaller shall be bronze, non-rising stem, wedge disc, 125 pound service, Crane No. 438, Kennedy Figure 427 or equal.

Gate valves larger than 3 inches shall be iron body, bronze mounted, resilient seat, wedge disc, left opening, high-strength bronze stem, O-ring with a 2-inch-square operating nut and complying with AWWA C509 or C515. Gate valves shall be non-rising stem unless noted otherwise.

Above ground gate valves shall be provided with handwheels. chain looped to extend to within 3 feet of finished floor.

2.2 BUTTERFLY VALVES

Butterfly valves for air service shall be iron body and disc, Viton resilient seat, stainless steel shaft, bronze bearings, lug body style, suitable for service in air to 350 degrees F. Air service butterfly valves shall be DeZurick, Pratt, or equal.

Butterfly valves for liquid service shall have iron body and disc, Buna N seats attached to the valve body, stainless steel shaft, corrosion resistant bearings, and flanged style body and shall comply with AWWA C504. Extension bonnets shall be sealed from liquid intrusion and shall encase the valve torque tube from the valve trunnion to the top-mounted geared handwheel actuator. The entire assembly shall be factory assembled and tested. Liquid service butterfly valves shall be DeZurik, Pratt 2FII, or equal.

Where butterfly valves are installed adjacent to check valves or other fittings, which interfere with the valve's full range operation, flange fillers, or other spacers, shall be installed between the valve and the obstructing fitting as necessary to insure unrestricted operation of the butterfly valve from full open to closed.

2.3 CHECK VALVES

A. LIQUID SERVICE

Check valves for liquid service 3 inches and smaller shall be swing check, bronze body, composition disc, 125 pound service.

Check valves for liquid service larger than 3 inches shall be swing check, outside lever and spring, iron body, stainless steel shaft, bronze mounted with bronze and stainless steel fittings, 125 pound service, Millikin, Mueller A2600 or equal.

Check valves for submerged or intermittently submerged service shall be ball check valves. Manufacturer shall be Flowmatic or equal.

B. FILTER TO WASTE

Check valves above the Filter to Waste air gap shall be a Flanged Tide Flex Series 35 Check valve or approved equal.

C. BACKWASH OVERFLOW

Check valves above the Filter to Waste air gap shall be a Flanged Tide Flex Series 35 Check valve or approved equal.

2.4 COMBINATION AIR AND VACUUM VALVES

The combination air and vacuum release valve shall allow unrestricted venting or re-entry of air, through it, during filling or draining of the pipeline, to prevent water column separation or pipeline collapse during vacuum. The air-vacuum release valve shall incorporate one upper and one lower stainless steel float connected by a common stainless steel float guide, thereby maintaining an air gap between the bottom float and top shut-off float. The internal baffle shall be fitted with a guide bushing and act to protect the shut-off float from direct air flow. The baffle shall retain the 45 Durometer Buna-N seat in place, without distortion, for thigh shut-off. All internals shall be easily removed through the top cover without removing the main valve from the lines. Both floats shall withstand 1,000 psi or more. Valve shall be fitted with blow off valves, quick disconnect couplings and a minimum of 6 feet of hose, to permit back flushing after installation without dismantling the valve. The combination air-vacuum release valves shall be APCO Model Series Series 100 (Water), or equal, with a shut-off and outlet valve, unless otherwise noted on the Plans.

Air release valves on potable water pipes shall be APCO Series 140, or equal. Each air valve shall be provided with an isolation valve for isolation on the inlet side. A vent pipe shall be routed from the valve to within 12 inches of the floor, unless otherwise noted on the Plans. Orifice shall be sized for maximum system pressure. Valve body shall have a minimum pressure rating of 150 psi. Pins, levers, retaining rings, float ball and internal screws shall be stainless steel.

2.5 PVC BALL VALVES

Ball valves shall be PVC Class 1245 4-B, conforming to ASTM D1784, true union type, threaded per ANSI B1.20.1, full port design, rated 150 psi, Nibco Chemtrol Tru-Block, Asahi/America, or equal.

2.6 BACKFLOW PREVENTERS

Backflow preventers shall be of the reduced pressure type, Febco, Watts, Beeco, or equal as approved by the State Health Department. Sizes to be as indicated on the Plans.

2.7 SOLENOID VALVES

Solenoid valves shall be two-way 1-1/2-inch size with 1-1/4-inch orifice. They shall be suitable for operating at pressures up to 125-psi differential pressure, and be rated up to 300 psi safe working pressure. All valves shall be normally closed, 120 VAC coil, rated continuous duty Class H, Molded Class A, UL approved. Valve shall be ASCO Model 8210, or equal.

2.8 CONTROL VALVE

All pressure reducing valves shall be globe type, ductile iron body, epoxy lined and coated with 150 pound flanged ends and rated for 250 psi. Seat shall be stainless steel. Valve shall be 3-inch, Cla-val Model 05-01.

All pressure sustaining valves shall Globe type, ductile iron body, epoxy lined and coated with 150 pound flanged ends and rated for 250 psi. Seat shall be stainless steel. Valve shall be 2-inch solenoid operated, Cla-val Model 58-42.

2.9 RUBBER CHECK VALVES

Check valve shall be a Tideflex Series 35 check valve or equal.

2.10 VALVE IDENTIFICATION TAGS

Each shut-off or control valve, shall be provided with a 1-1/2-inch minimum diameter heavy brass tag. Tags shall bear the identifying number of the valve and one or more identifying letter symbols of the service line.

Numbers and letters shall be block type with 1/2-inch-high numbers and 1/4-inch-high letters stamped on the tags and filled with black enamel.

Attach tags to the valves by split-key rings soldered so that the ring and tag cannot be removed.

Furnish a drawing and a neatly typed valve directory listing each valve number, type of valve and its location. Submit the directory and drawing to the Owner for approval.

2.11 VALVE BOXES

There shall be furnished and installed with all valves installed underground, two piece adjustable cast iron valve boxes with a minimum inside diameter of 5 inches. The valve boxes shall be set concentric with the axis of the stem and adjusted to the finish grade. Valve box lids shall be identified with a letter/number code and opening direction designation as shown on the Plans.

PART 3 EXECUTION

3.1 GENERAL

All valves and accessories shall be installed in a manner and location as shown on the Plans or as required for the application and in accordance with manufacturer's instructions. Valve size is fully equal to line piping in which the valve is installed unless otherwise noted on the Plans. Support all valves where necessary. In case on conflict between these Specifications and a governing code, the more stringent standard shall prevail.

All valves of the same style or type shall be furnished by a single manufacturer.

Provide all accessories necessary for proper valve operation as specified or required for the application. Buried valves shall be installed with square operating nuts and adjustable cast iron valve boxes with covers. Valve boxes shall be set such that the slots in the boxes are in line with the run of pipe the valves are in. Provide two sets of T wrenches for buried valve operation.

Buried valves shall be provided with 1-inch solid steel extension stems with rock guards if the operating nut will be 18 inches or more below the ground surface.

Valves shall be installed with the operator in a position for convenient operation. Particular care shall be taken to insure that space is available for operation of lever or handwheel operated valves without interference to walls, piping or equipment. Any valve which is installed, in the opinion of the Engineer, in a manner that operation is inconvenient shall be modified or removed and reinstalled in a manner suitable to the Engineer at the expense of the Contractor. Operations for manual valves shall be lever or handwheel as is standard with the manufacturer unless another type of operator is specified or required by the manufacturer.

For submerged valves, provide stem guides as recommended by the valve manufacturer on a spacing of 6'-0". As an alternate, provide valves with extended bonnets where practical. Provide supports for extended bonnets as required. Stem guides and supports shall be 316 stainless steel. All installation fasteners for

submerged valves, guides, and supports (nuts, bolts and washers) shall be 316 stainless steel.

3.2 CONTROL VALVE

The services of a factory trained representative of the control valve manufacturer shall be provided. Services shall include a half day onsite and one additional half day for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. The cost of these services shall be included in the bid price. Instruction and training shall not take place until valve startup is completed and the valves are fully operational.

Contractor shall supply upstream and downstream pressure for testing of control valve including gauges to supply the pressure required.

***** END OF SECTION *****

SECTION 15400

PLUMBING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of plumbing to include interior water systems, drain and waste systems, and fixtures and trim as shown on the Plans and specified herein.

All permits shall be obtained in accordance with Section 01160 of these Specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01160	Regulatory Requirements
01300	Submittals
15050	Piping Systems

1.3 REFERENCES

ASTM B62	Specification for Composition Bronze or Ounce Metal Castings
ASTM B88	Specification for Seamless Copper Water Tube
ASTM B371	Specification for Copper-Zinc Silicon Alloy Rod
AWWA C502	American Water Works Association Standard for Dry-Barrel Fire Hydrants

1.4 MANUFACTURERS

Use products of a single manufacturer where two or more units of the same class of equipment are required.

1.5 QUALITY ASSURANCE

All plumbing shall be performed in accordance with the current edition of the Uniform Plumbing Code. The Plans do not detail all items such as complete venting, etc.; however, it is understood that this work shall be included as part of this Project.

1.6 DELIVERY, STORAGE, AND HANDLING

Material shall be delivered to the project site in its original unopened containers with labels informing manufacturer and product name. Material shall be stored and handled in compliance with manufacturer's recommendation to prevent damage.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS - DRAIN AND WASTE SYSTEM

A. BURIED PIPE

All drain, waste and vent pipe shall be hubless, cast iron, standard weight pipe conforming to the requirements of the latest issue of CISPI Standard #301, ASTM A888, or ASTM A74, as manufactured by AS&I, Charlotte, Tyler or equal.

B. ABOVE GROUND PIPING

All drain, waste and vent pipe shall be hubless, cast iron, standard weight pipe conforming to the requirements of the latest issue of CISPI Standard #301, ASTM A888, or ASTM A74, as manufactured by AS&I, Charlotte, Tyler or equal.

C. FITTINGS

All fittings and pipe joints shall be hubless, conforming to the requirements of the latest issue of CISPI Standard #301.

D. COUPLINGS

Hubless coupling gaskets shall be the heavy-duty type with dual stainless steel pipe clamps on each side, and shall conform to ASTM C1540, as manufactured by Anaco, Tyler or equal.

2.2 FLOOR DRAINS

A. GENERAL

J.R. Smith, Zurn, Josam or Wade equal to J.R. Smith models listed.

1. Floor Drain – FD – 2320, galvanized with a nickel bronze top.

2. Small Floor Drain – FD – 200 Series, galvanized with a nickel bronze top.
3. Funnel Floor Drain – FFD – 2320, galvanized with a nickel bronze top and 6-inch-diameter funnel.

2.3 CLEANOUTS

A. GENERAL

J.R. Smith, Zurn, Josam or Wade equal to J.R. Smith models listed.

1. Grade Cleanout - GCO - 4283 - brass tapered thread plug.
2. Floor Cleanout - FCO - 4023 - brass tapered thread plug.

PART 3 EXECUTION

3.1 PIPE AND PIPE FITTINGS - DRAIN AND WASTE SYSTEM

A. BURIED DRAIN PIPE

Install with not less than 1 foot of cover, measured from top of pipe to approved finish floor. Install pipe in accordance with the manufacturer's recommendations. Construct drain lines under other utilities where necessary to meet the minimum cover requirements.

B. HORIZONTAL SOIL AND WASTE PIPE GRADING

Provide a grade of 1/4 inch per foot where possible, but in no case less than 1/8 of an inch per foot. Install main vertical soil and waste stacks with provisions for expansion and extend full size to roof line as vents.

C. PIPES

Remove burrs by reaming. Use Teflon tape on male threads only.

D. OPENINGS IN PIPES

Keep closed during progress of work.

E. COORDINATION

Install so as not to interfere with light fixtures or other trade components.

3.2 CLEANOUTS

Provide every 50 feet and install at all locations required by code and to permit cleaning of all sewer piping. Provide cleanouts full size of pipe, but not larger than 4 inches. Close cleanout openings with brass screw plugs. Where cleanouts occur in floor, install a brass ferrule complete with a screwed brass cover, flush with floor. Install cleanout threads with graphite. Locate cleanouts to clear cabinet work and make them easily accessible.

3.3 EXISTING UTILITIES

Locate well enough in advance of the excavation to prevent damage during construction. The Contractor is responsible for any damage whatsoever resulting from his operations on the project.

3.4 CONTAMINATION

Prevent contamination of the pipeline during construction from any operation or source.

3.5 INSPECTION

It shall be the Contractor's responsibility to contact the Owner and arrange for final inspection.

***** END OF SECTION *****

SECTION 15700

HEATING, VENTILATION, AND AIR CONDITIONING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of the heating, ventilation, and air conditioning equipment and other associated items as shown on the Plans, and as further specified herein.

All permits shall be obtained in accordance with Section 01160.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01160	Regulatory Requirements
01300	Submittals
Division 16	Electrical

1.3 QUALITY ASSURANCE

Submittals shall be in accordance with Section 01300.

All equipment supplied in this Section shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on shop drawing submittal for review.

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 operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work to ensure connecting and disconnecting accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Oil and lubrication fittings shall be located clear of and away from guards, base, and equipment and within reach from the operating floor whenever possible. In order to meet these requirements with equipment as furnished, minor deviation from the Plans may be made as approved by the Owner.

The manufacturer's recommendations and instructions of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.4 PROJECT MEETINGS

Attend a minimum of two site meetings, each up to 2 hours in duration. The first site meeting will be held after 95 percent of the HVAC equipment and controls have been installed. Any required training should be scheduled and performed at this first site meeting. A follow up site meeting shall be scheduled 6 months after the complete installation of the HVAC and controls to ensure proper operation. Any additional training required should be scheduled and performed at the follow up site meeting.

1.5 EQUIPMENT LIST

Refer to Heating, Ventilation and Air Conditioning Schedules shown on the Plans.

1.6 SUBMITTALS

Submit manufacturer product data on HVAC equipment, as listed in this Section, under the provisions of Section 01300.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Equipment manufacturers and model numbers shall be as shown on the Plans except where indicated herein.

2.2 LOUVERS

Louver performance data shall be licensed under the AMCA Certified Ratings Program and shall bear the AMCA Certified Ratings Seal. Certified performance data shall include airflow pressure loss and water penetration.

A. DRAINABLE BLADE

Louvers shall be stationary type with drainable blades in a 6-inch louver frame. Each stationary blade shall incorporate an integral drain gutter and each jamb shall incorporate an integral downspout so water drains to blade end, then down the downspouts and out at the louver sill. The louver construction shall consist of a frame and blades from aluminum extrusions of minimum 0.081-inch nominal wall thickness. The blades shall be positioned at 37 degree angles. Each louver shall be equipped with a framed, removable, 0.125 x 3/4 flattened aluminum rear-mounted bird screen or 16 x 18 mesh aluminum insect screen. Louvers shall be supplied

with a Kynar finish which meets AAMA 2605. Each factory-assembled louver section shall be designed to withstand wind loadings of 25 psf. Drainable blade louvers shall be Greenheck ESD series, or equal.

B. COLOR SELECTION

Louver color to be selected by Owner from the manufacturer's standard palette of at least 24 colors.

2.3 GRAVITY BACKDRAFT DAMPERS

Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.

Gravity backdraft dampers shall be suitable for pressures up to 1-inch w.g., velocities to 2,500 ft/min and temperatures to 180 degrees F. Gravity-operated back draft dampers shall rotate to the fully open position in the direction of the airflow when subjected to a differential pressure of 0.2 of an inch w.g. or less. Gravity damper construction shall consist of minimum 18-gauge galvanized steel frame with 2.5-inch to 3.5-inch depth; aluminum blades; 304 stainless steel axles turning in acetal bearings. The damper shall be equipped with extruded vinyl blade seals; and internal aluminum tie bar with spring assist. Finish shall be as shown on equipment schedule. Gravity backdraft dampers shall be Greenheck WD series, or equal.

2.4 SIDEWALL DIRECT DRIVE AXIAL PROPELLER FANS

Fans shall bear the AMCA Certified Ratings Seal for both sound and air performance and be UL tested and approved.

Propellers shall be constructed with fabricated aluminum, or cast aluminum blades and hubs. A standard square key and setscrews or tapered bushing shall lock the propeller to the motor shaft. All propellers shall be dynamically balanced.

Motors shall be permanently lubricated, heavy-duty type, carefully matched to the fan load and furnished at the rpm, voltage, phase, and enclosure of the model shown on the Plans.

Motor drive frame assemblies and fan panels shall be galvanized steel. Drive frame assemblies shall be welded wire or formed channels and fan panels shall have prepunched mounting holes, formed flanges, and a deep-formed inlet venturi.

Direct drive sidewall propeller fans shall be Greenheck S series, or equal.

2.5 UNIT HEATERS

Heaters shall be UL Listed, CSA Certified and meet requirements of the National Electrical Code.

Heaters shall be horizontal or vertical mount type. Heater housing shall be constructed of heavy gauge steel. Heaters shall be fan-forced air unit with aluminum finned, copper clad heating elements. The fan shall be completely enclosed and dynamically balanced. The unit shall be complete with pivotal wall or ceiling mounting kit as specified on Plans, control transformer, automatic reset thermal overheat protector, adjustable louvered outlet grille and enamel finished steel housing; all shall be one unit supplied by the same manufacturer. Unit heaters shall be Qmark MUH series, or equal.

2.6 DEHUMIDIFIERS

Dehumidifier shall be a standalone, packaged, compressor style dehumidifier system for industrial applications. Construction shall be heavy gauge, epoxy coated steel. System components shall include an evaporator coil with condensate collection tray, a condenser coil, a refrigerant compressor, a two-speed circulation fan, hot-gas defroster, and condensate drain hose connection. Controls shall be an integral, adjustable humidistat. The system shall run on 220V, single phase, 60 Hz power. System shall be capable of extracting 190 pints of water per day in 80 degrees F and 80 percent RH conditions. System shall be capable of operating between 33 degrees F and 95 degrees F. Dehumidifier shall be EBAC PD200, or equal.

2.7 MODULATING THERMOSTATS

Provide thermostats, as required to control heating and ventilating equipment. Thermostats shall be located on an interior wall that does not receive direct solar exposure unless otherwise indicated. Adjustment screws and temperature-setting indicator shall be accessible without opening the enclosure.

Modulating thermostats shall be control designed to regulate fan speed based on level of temperature space. Control shall include a Proportional Integral Derivative (PID) feedback loop and shall have labeled terminal strips for easy wiring. Control shall output a 0-10 VDC signal to operate an electronic commutation (EC) motor. Temperature setpoint range shall be 50-90 °F. Modulating thermostats shall be Greenheck Temperature/Humidity Control, or equal.

2.8 TAPE

Non-combustible, three inches in size, foil backing, pressure-sensitive lap of facing material. NASHUA 322, or equal.

2.9 DUCT SEALANT

Duct sealant shall be Foster 32-19 Duct-Fas, or equal.

2.10 METAL DUCTWORK

Metal ductwork for air supply and return air shall be fabricated in accordance with ASTM A527 (galvanized sheet metal) or ASTM A167, ANSI Type 302/304 (stainless steel sheets) if S.S. ductwork is shown on the Plans. Metal ductwork shall be rigidly constructed and installed. Slip joints shall be in the direction of air flow. All joints shall be sealed tight. Bonding materials for sealing duct system and attaching insulation shall be supplied by manufacture. Ducting shall be United McGill, SMACNA or equal.

Hangers shall be secured to the ceiling or walls and shall be adequate to support ductwork. Where ducts go through walls, there shall be 1/4-inch clearance left and this area shall be sealed tight with compatible mastic and foam rubber and the penetration area covered over with flanges that are secured to the ductwork only. Volume dampers shall be located as shown on the Plans, and at a minimum of one damper for each branch duct installed. Dampers are to be of the same material as the ducts they are installed in. Fire dampers shall be installed in ductwork as directed by the Building Permit or required by the Owner.

Ductwork shall be installed and supported to comply with the requirements and recommendations of Sheet Metal and Air Conditioning Contractors National Association (SMCACNA) HVAC Duct Construction Standards. Sheet metal plenum shall be constructed of not lighter than 18-gauge galvanized steel and reinforced with 1-1/2-inch by 1-1/2-inch by 1/8-inch angles as required to prevent drumming or breathing. Access openings and covers shall be provided for cleaning, wiring and servicing motors, filters, fans and dampers located within or blocked by sheet metal work.

2.11 DUCT HANGERS AND SUPPORTS

Comply with requirements and recommendations of Sheetmetal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standards.

Conform to requirements of SMACNA “Seismic Restraint Manual Guidelines for Mechanical Systems.”

Furnish standard and fabricated hangers and supports complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

Hanger straps and rods shall be in accord with SMACNA Duct Construction Standards.

Fasten bracing to ductwork, including riveting, bolting, and tack welding per SMACNA.

Provide galvanized steel band or fabricated angle iron brackets for wall supports, except in wet well area where stainless steel components are required.

A. HANGER RODS

Carbon Steel, with hex nuts and flat washers.

B. CONCRETE INSERTS

1. Continuous channel - Unistrut.
2. Universal, malleable iron - Type 18, FS WW-H-171.

Beam Clamps and Attachments as required.

2.12 SEISMIC SUPPORTS

All HVAC supports, tie rods, bracing, brackets or other types of supports shall be designed in accordance with the current edition of the International Building Code (IBC) and ASCE 7-10. Evaluate the seismic loads in accordance with IBC and Chapter 13 of ASCE 7-10 for the seismic design parameters shown on the Plans.

PART 3 EXECUTION

3.1 INSTALLATION

All materials shall be installed as shown on the Plans and according to manufacturer's recommendations. Adjust all dampers and louvers to provide tight seal when closed and unobstructed flow when open. Provide all necessary controls, and coordinate all control wiring with Division 16. All installed equipment shall function in manner intended.

The heating/cooling system shall be installed as shown on the Plans. The Contractor shall be responsible for the installation of any condensate drain piping and conduit/wire runs for controllers/thermostats.

3.2 TESTING, ADJUSTING AND BALANCING

A. QUALIFICATIONS

All work shall be performed under the direct supervision of an AABC Certified Test and Balance Engineer. Resumes including education, experience, and certification of each person on the project shall be submitted for review and approval by the Owner. Notify the Owner 10 days prior to testing. The Owner shall witness the testing and balancing.

B. INSTRUMENTATION

All instruments used will be currently calibrated and listed in the TAB report showing instrument description, serial number, and date of calibration.

C. AIR BALANCE

When systems are complete and ready for operation, the TAB Agency will perform a final air balance for all air systems and record the results. The volume of air for the supply, return, exhaust, and outside air equipment and terminals will be tested and balanced within the tolerances of the AABC Standard. The general scope of balancing by the TAB Agency will include, but is not limited to, the following:

1. Fan Speed

Measure and record RPM at each fan speed.

2. Voltage and Amperage Readings

Measure and record the final operating amperages and voltage for each motor.

3. Static Pressure Profile

Static pressure profiles shall be measured and recorded across each fan. Static pressure profiles shall also be provided for systems, which do not perform as designed.

4. Equipment Air Flow

Adjust and record exhaust, return, outside, and supply air CFM and temperatures, as applicable, at each fan.

D. REPORTS

The report will contain all required information as described within this specification, including the information formatted and shown in the AABC Standard. Include with the data the date tested, personnel present, records of test instruments used, and a list of all measurements taken. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the reports shall be certified by the Agency's Test and Balance Engineer. Six copies of the final report shall be submitted to the Owner indicating a summary of actual operating data and any abnormal operating conditions.

E. EXECUTION

1. Put all systems and equipment into operation and continue operation until all adjusting, balancing, testing, demonstrations, instructions, and cleaning of systems have been completed.
2. Do not begin testing and balancing until systems are completed and in good working order.
3. Check motors for proper rotation, coupling and drive alignment, belt tension, and freedom from vibration, etc.
4. Make all changes to drives and dampers as necessary to accomplish specified airflows.

*****END OF SECTION*****

DIVISION 16

ELECTRICAL

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the requirements and methods for furnishing and installing the basic electrical materials, and other associated items as shown on the Plans, and as further specified herein.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01800	Testing, Commissioning, and Training
02300	Site Earthwork
Division 3	Concrete
09900	Painting
11000	Equipment General Provisions
Division 15	Mechanical
Division 16	Electrical

1.3 DEFINITIONS

A. ADJUSTABLE SPEED DRIVE CONTROLLERS

Adjustable speed drives are variable frequency AC drives used to power AC squirrel-cage induction motors at variable frequencies, which relate directly to variable speed. These drives are also commonly known as Variable Frequency Drives (VFDs).

Basic design typically consists of AC to DC conversion followed by AC output wave simulation using pulse-width modulation (PWM). This simulated output power signal will appear to the motor as a representation of an adjustable frequency sine wave. This output may be electrically noisy.

B. ANALOG I/O

Analog I/O are PLC input/output electronic signals that are contiguous over time. Analog signals represent a large number of values within a specific range.

C. ATTICS

Attics shall be considered those closed environments between ceilings and roofing that allow full entry of personnel by use of ladders, pull-down stairs, or other special means.

ATTICS are considered dry crawl spaces (see CRAWL SPACES).

Tight spaces between ceilings and roofs that do not allow full entry of personnel are considered concealed areas (see CONCEALED AREAS).

D. CHEMICAL AREAS

Locations where process chemicals are stored or used within a process in either a confined or open manner. Chemical areas may be exposed to chemical solids, liquids, or gases as a result of normal operation, system maintenance, or spills/leaks.

E. CONCEALED AREAS

Locations that are underground, within walls, or within other areas that do not allow full entry of personnel are considered concealed. Concealed areas are not exposed (see EXPOSED AREAS) or accessible (see ATTICS and CRAWL SPACES).

F. CONTROL PANELS

Control Panels shall be defined as enclosures that contain electrical devices capable of controlling, altering, indicating or displaying the function or conditions of electrical circuits. Unlike junction boxes, Control Panels are not just used for the redirection or reconnection of electrical circuits.

G. CONVENIENCE RECEPTACLES

120 Vac general-purpose receptacles that are not dedicated to a specific function or piece of equipment. Receptacles dedicated to computers, heat tracing, fans, louvers, and etc., are not considered convenience receptacles.

H. CRAWL SPACES

Crawl spaces shall be considered those closed environments that are not normally accessible to personnel, but that allow full entry of personnel by special means.

Crawl spaces are considered exposed areas and may be dry or wet (see ATTICS).

I. DAMP AREAS

Damp areas are considered wet (see WET AREAS).

J. DEDICATED RECEPTACLES

Dedicated receptacles are provided for a specific receptacle load such as computers, heat tracing, fans, louvers, metering pumps, sump pumps, and etc. Dedicated receptacles are not intended for general use.

K. DIGITAL I/O

A digital I/O point consists of a single input or output binary bit at one of two possible states, which may be represented as 1's or 0's, ON or OFF, YES or NO, TRUE or FALSE, etc. Digital I/O may also be called "discrete" I/O. Within these specifications, both terms are synonymous.

L. DRY AREAS

Locations not normally subject to dampness or wetness. A location classified as dry may be temporarily subjected to dampness or wetness, as in the case of a building under construction (see FINISHED AREAS).

Rooms containing process water, chemical piping, or related equipment are not considered DRY. Areas that are not considered DRY are considered WET.

M. EXPOSED AREAS

Locations that are visible, outdoors, or exposed to a process or room environment. Exposed areas are not concealed (see CONCEALED AREAS).

N. FINISHED AREAS

Indoor confined areas that are not directly exposed to a process or process chemicals. They typically include closed offices, bathrooms, laboratories, lunch/break rooms, etc. Finished areas are considered DRY.

O. HAZARDOUS AREAS

Class I, Divisions 1, and 2; Class II, Divisions 1 and 2; Class III, Divisions 1 and 2 locations where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings (reference National Electrical Code, Article 500).

P. HIM

Human Interface Module – A programmable operator interface directly associated with, or integral to, an electrical control device (such as a VFD or Soft Start drive). This interface displays device setpoints and status with a keypad for data entry.

Q. HMI

Human Machine Interface – The way a person interacts with a computer or electronic device. It comprises the screen menus and icons, keyboard shortcuts, command language, and help functions. Peripheral support devices, such as a mouse, keyboard, touch screen, and remote controls are also included. The HMI system is typically PC based, located in an office or lab environment.

R. HOT SPARE

A “Hot Spare” is a PLC analog or digital channel in a PLC card that is powered but the channel is unassigned. Hot spares are connected to fused field I/O terminal block groups per Specification 16940.

S. INDOOR AREAS

Confined locations where the equipment is normally protected from wind, dust, rain, snow, and other natural elements. INDOOR areas are not the same as DRY areas.

T. I/O

Inputs/Outputs – Input and output signals into and out of a PLC or RTU.

U. LEGALLY REQUIRED STANDBY SYSTEMS

Those systems required and so classed as legally required to have standby power by Government requirements.

V. OIU

Operator Interface Unit – A graphical display of industrial plant system variables and status. It may also allow for process control adjustments. Navigation of its programming may be via keypad, touch screen, or a combination of both. An OIU is typically located on a field control panel or control panel in an electrical equipment room.

An Operator Interface Unit is considered a possible extension of a PLC, like an I/O or network card. PLC installations may or may not include an OIU.

W. OUTDOOR AREAS

Locations where the equipment is normally exposed, or partially exposed, to weather in the form of wind, dust, rain, snow, and other natural elements.

X. PROCESS AREAS

Process areas are those areas that are directly exposed to process moisture, or that may be subjected to moisture in the event of a process leak or failure. They typically include pump rooms, chemical rooms, and direct process-exposure areas such as clearwells, open filters, and reservoirs. Process areas are considered WET.

Y. PLC

Programmable Logic Controller – A device used to monitor and control system process. It can be used stand-alone or in conjunction with other systems such as SCADA. It may provide telemetric functions or interface with telemetric equipment.

Z. RTU

Remote Telemetry Unit/Remote Terminal Unit – A device that reads the status of process devices and transmits them to another telemetric unit. RTUs may transmit a command from another source but will not alter or interpret the command. RTUs differ from PLCs in that they do not control a process.

AA. SCADA

Supervisory Control and Data Acquisition (SCADA) systems are data monitoring and control stations that allow operators to visualize and adjust

live process conditions at a centralized HMI. These systems often include process historical data tracking and alarming capabilities. SCADA systems can be used for data monitoring locally, remotely, or both.

BB. SHOP FABRICATED

Manufactured or assembled equipment for which a UL test procedure has not been established.

CC. SOFT START MOTOR CONTROLLERS

See SOLID STATE MOTOR CONTROLLERS in this Section.

DD. SOLID STATE MOTOR CONTROLLERS

Solid State motor controllers provide an electronically controlled acceleration and deceleration of AC squirrel-cage induction motors. Once the motor has reached full speed, the electronics are switched off and replaced with a motor drive contactor that connects the motor directly to line power, thus assuring continuous full voltage to the motor. Solid State motor controllers are also referred to Soft Start motor controllers.

Unlike VFD drives, Solid State motor controllers do not alter the sine wave *frequency* to the motor; instead they alter the portion of the sine wave that reaches the motor. This controls the amount of power sent to the motor and affects the motor's ability to create torque. The electronic Solid State control is only used during acceleration and deceleration. During acceleration the controller switches the waveform from 0 up to 100 percent (full voltage) and during deceleration switches the waveform from 100 down to 0 percent (no voltage).

EE. TELEMETRY

Telemetry is the transfer of data between remote sites. Typical methods of data transfer are utility phone lines, radio transmission, and fiber optics.

FF. VARIABLE FREQUENCY DRIVES (VFDs)

See ADJUSTABLE SPEED CONTROLLERS in this Section.

GG. VIBRATING EQUIPMENT

Equipment that is subject to vibration under normal operating conditions, such as motors, transformers, electrically operated valves, etc.

HH. WET AREAS

Locations outdoors, underground, directly or indirectly exposed to the process, in concrete slabs or masonry in direct contact with the earth, or in any other way subject to saturation with water or other liquids.

1.4 REFERENCES

Unless otherwise noted, the requirements of the following code-making authorities and standard organizations apply:

<u>References</u>	<u>Title</u>
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society of North America
ISA	Instrument Society of America
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NRTL	National Recognized Testing Laboratory
OSHA	Occupational, Health, and Safety Administration
UL	Underwriters Laboratories, Inc.
UL 508	Safety Industrial Control Equipment
UL 698	Industrial Control Equipment for Use in Hazardous Locations
WAC 296-46B	Washington Administrative Code, Electrical Safety Standards, Administration, and Installation

In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, plans, and specifications, the more stringent condition shall govern.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Prior to submittal of shop plans, coordinate all electrical equipment, particularly motor control equipment, process and control panels, and instrumentation, with related manufacturers and with other applicable equipment and systems specified in other divisions of the Specifications.
- C. Provide submittals in the following manner:
 1. Organize the submittals by CSI code type.

2. Clearly show the Tag Number associated with each submittal within each CSI grouping.
 3. Include non-tagged devices such as grounding systems, conduits, wireway, ductbank details, wire, cable, boxes, fittings, switches and receptacles.
 4. Clearly show the specific part, part number, order code, etc. associated with the device. Use pointers, highlights, circles, etc. to clearly identify the specific part.
 5. Submit on distribution equipment, including but not limited to: Unit substations, Medium voltage switching equipment, motor control centers and control equipment, low voltage switchboards, safety switches, dry-type (specialty) transformers, panelboards, and grounding.
 6. Submit on generators and automatic transfer switches.
 7. Submit on lamps, lighting, site lighting, and wiring devices.
- D. Provide manufacturer's product technical data including, but not limited to:
1. Manufacturer's name, address, and contact number.
 2. Manufacturer's product descriptive bulletin.
 3. Nameplate data, current, voltage, load, impedance, and other electrical data pertinent to the Project and necessary to assure compliance with the Specifications and Plans.
- E. Provide elementary wiring diagrams for the electrical control systems showing the wiring of electrical control items, such as starters, control systems, interlocks, switches, and relays as they apply to this Contract.
- F. Provide schematic interconnection diagrams and/or PID diagrams for each control system and each control panel. Each control diagram shall show a schematic representation of the process equipment and the locations of the switches, meters, automatic valves, indicators, controllers, and recorders. Show correct operating settings and ranges for each control instrument on the diagrams.

G. Use diagrams and symbols in shop plans, which conform to JIC Electrical Standards for Industrial Equipment and/or NEMA, ICS, ANSI, and IEEE standards, latest revisions. Prepare plans on 22" x 34", or ANSI size A, B, or D in a format similar to the Contract Documents or other nationally recognized drawing standard.

H. Clearly, indicate on submittals that the equipment or material is NRTL listed or is constructed of listed or recognized components. Where a NRTL standard has not been established, clearly identify that no NRTL standard exists for that equipment.

I. OPERATION AND MAINTENANCE MANUALS

Reference base requirements in specification 01300.

Manuals for the electrical system shall also include:

1. Manuals for Motor Control Centers. MCC wiring diagrams shall include updated title block showing the date redline field changes were incorporated into the documentation.
2. Manuals for fabricated control panels. Wiring diagrams shall include updated title block showing the date redline field changes were incorporated into the documentation.
3. In each section, compile a spare parts list and supplier index.
4. Assemble records of all tests, measurements, and calibration settings made for each device.
5. The Contractor shall supply three CD-Rom or USB copies of the final equipment manuals in a tabbed, searchable, .pdf format, with a table of contents bookmarked to provide a navigation link to each section of the manual(s).

1.6 SYSTEM DESCRIPTION

- A. Provide the labor, materials, and equipment necessary to furnish, install, and place into operation complete power, lighting, control, alarm, communications, and instrumentation electrical system of this Contract as shown on the Plans or Specifications herein.
- B. Provide a functioning system(s) in compliance with manufacturer's instructions, performance requirements as specified or indicated, and

modifications resulting from reviewed shop plans and field coordinated plans.

- C. Provide complete wiring and controls for all equipment specified under other divisions and that comply with Division 16.
 - 1. Connect motors, controls, meters, and any other electrical device installed or provided as part of the project.
- D. Pay and make arrangements for necessary permits, licenses, and inspections.

1.7 QUALITY ASSURANCE

A. TESTING AGENCY QUALIFICATIONS

A “Nationally Recognized Testing Laboratory” (NRTL) recognized and approved by the State of Washington.

- 1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies, or equal, to supervise onsite testing specified in Part 3.

- B. Comply with NFPA 70 (NEC) for components and installation.

C. LISTING AND LABELING

Provide products specified in this Section that are listed and labeled.

- 1. The Terms “Listed and Labeled:” As defined in the National Electrical Code, Article 100.
- 2. Listing and Labeling Agency Qualifications
 - a. A NRTL recognized and approved by the State of Washington.

1.8 DELIVERY, STORAGE AND HANDLING

Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage – either inside or on top of enclosures. Protect nameplates on electrical equipment from being defaced. Repair or replace damaged, corroded, and rejected items at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Refer to individual Division 16 sections.
 - 1. Similar equipment shall be provided by only one manufacturer throughout the project unless otherwise noted in the Specifications.
- B. Submit requests for substitution in accordance with Section 01300.
- C. Trade names and catalog numbers may be used in the Plans or Specifications to establish quality standards and basis of design:
 - 1. Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.

2.2 GENERAL PRODUCT REQUIREMENTS

- A. Except as otherwise indicated, provide new materials and equipment, which are standard products of manufacturers, regularly engaged in production of such equipment. Provide material or equipment approved and labeled for the purpose for which it is to be used by NRTL or other organizations acceptable to the State of Washington Department of Labor and Industries.
- B. Where voltage, current, power, temperature or other ratings are specified that do not correspond to standard ratings of the manufacturer selected by the Contractor, furnish the next rating level which is more conservative or increases the capacity of the device or material in question.
- C. Furnish materials, devices, and equipment that are non-corrosive or coat them in a manner that renders them non-corrosive and acceptable to the Engineer. Do not provide materials, which contain polychlorinated biphenyls, asbestos, or other hazardous or detrimental materials. Do not install materials in a location or construction manner that produces galvanic action or do not install material combinations with corroding or eroding action.
- D. Where changes in the work, or substitutions in material are proposed, ensure that sizes, weights, openings, etc., are provided that do not require changes in the work outside this Division.
- E. All terminals shall be suitable for 75 degrees C rated copper conductors.

2.3 FABRICATION

- A. When equipment is shop fabricated specifically for this Project, use electrical devices and enclosures, which are NRTL, listed and labeled or recognized.
- B. **SHOP OR FACTORY FINISHES**
 - 1. See Division 11 and Section 09900.
 - 2. Interiors of other painted electrical equipment shall be either white or light gray.
- C. Fabricate equipment or devices in the field equivalent in every respect to manufactured items used for the same purpose. Where cutting, drilling, grinding, etc., is done to galvanize or painted metal, regalvanize, or paint to match original finish.

2.4 SUPPORTING DEVICES

- A. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support from the building structure for electrical components.
 - 1. **Material**

Steel, except as otherwise indicated, protected from corrosion with zinc coating, or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
 - 2. **Metal Items for Use Outdoors or in Damp Locations**

Hot-dip galvanized steel, or stainless steel, except as otherwise indicated.
- B. **ANCHORS**

Galvanized steel in dry areas; stainless steel or hot dipped galvanized steel in wet areas.

 - 1. Lag screws or Type A tapping screws for wood.
 - 2. Rockwell “well-nut” for light loads in masonry.

3. Thru-bolt with fender washers for heavy loads in masonry.
4. Toggle bolts with springhead for hollow partitions.
5. Self-drilling anchors with threaded studs for concrete.
6. Clamps or U-bolts for structural steel.
7. Self-drilling anchors with extension rods for hollow tile over concrete.

C. SHEET-METAL SLEEVES

0.0276 of an inch or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.

D. PIPE SLEEVES

ASTM A53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

2.5 ELECTRICAL IDENTIFICATION

A. MANUFACTURER'S STANDARD PRODUCTS

Where more than one type is listed for a specified application, selection is Installer's option but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and Specifications.

B. COLORED ADHESIVE MARKING TAPE FOR RACEWAYS, WIRES, AND CABLES

Self-adhesive vinyl tape, not less than 3 mils thick by 1 inch wide.

C. UNDERGROUND LINE WARNING TAPE

Provide bright-colored, vinyl tape not less than 3-mils thick by 6-inches wide compounded for direct-burial service with permanent and continuous print.

D. TAPE MARKERS

Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

E. COLOR-CODING CABLE TIES

Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

F. FASTENERS FOR PLASTIC-LAMINATED AND METAL SIGNS

Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

G. FLASH PROTECTION WARNING

Provide Arc Flash Warning Label on all equipment as required by 110.16 NEC (2020). The label is to contain the following text:

WARNING or DANGER
Arc Flash Hazard!
Follow requirements in NFPA 70E
for safe work practices and
appropriate PPE. Failure to comply
can result in death or injury.

2.6 TOUCHUP PAINT

Use touchup paint on equipment provided by equipment manufacturer and select color to match existing equipment finish.

A. FOR NON-EQUIPMENT SURFACES

Matching type and color of undamaged, existing adjacent finish.

B. FOR GALVANIZED SURFACES

Zinc-rich paint recommended by equipment manufacturer.

PART 3 EXECUTION

3.1 ELECTRICAL SUPPORTING METHODS

A. WET AREAS

1. For pullboxes and equipment vaults, reference Specification Section 16130.
2. For wet areas which are not pullboxes or equipment vaults, hot-dip galvanized materials, stainless steel materials, or nonmetallic,

U-channel system components unless otherwise noted on the Plans.

B. DRY AREAS

Hot-dip galvanized materials unless otherwise noted on the Plans.

C. METHODS

Support raceway, equipment, and devices from framing members or building structure with sufficient clearance for maintaining and servicing. Provide backing plates, and/or framing material to support equipment, devices, and materials, which are located between the building or facility structure-framing members.

3.2 RECORDS

- A. Maintain and annotate on the job at all times a separate set of Record Drawings in accordance with the General Conditions. Show changes from the Contract Documents, routing of hidden raceways, actual fixture and equipment locations, equipment sizes and dimensions and building outline changes. At the end of the Project, provide the Engineer a complete set of Plans marked in red pencil in a manner consistent with the Contract Plans, indicating the changes made on the job.
- B. Record voltage, current, and megohmmeter and ground ohmic resistance test measurements made on the electrical work, the trip units, fuses, and overload relay elements installed in the equipment and the setting of all pressure, flow, level, etc., control devices. When the Project is completed and operating, turn over these records to the Owner.
- C. Equipment and raceways installed under this contract for future work shall be dimensioned on the Record Drawings.

3.3 COORDINATION

- A. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations. Obtain approval from structural Engineer for penetration of structural components prior to penetrating the component.
- B. Coordinate installation of supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

- C. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- D. Coordinate the location of motors, switches, panel connections, and other points of connection with the equipment manufacturers or vendors prior to conduit installation. Route circuits to the actual connection point. Even if removal and reinstallation of building materials is necessary, remove and reinstall conduit, outlet boxes, and other electrical connections, if initial electrical connections are not made to the appropriate equipment location.
- E. Coordinate and schedule connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate and verify work under Division 16 with work under other Divisions, cooperate in locating equipment to avoid interference with work of others, and plan work to harmonize with the work of other trades so that all work may proceed as expeditiously as possible. Coordinate the installing of built-in work, attaching items to buildings, and cutting and patching. Coordinate connecting electrical circuits to components furnished under other Divisions. (Portions of the electrical design are based upon the equipment specified in other Divisions.) No extras are allowed because of moving work required to avoid interference with work of other Contractors.
- G. Coordinate the interruption of electrical systems to any part of the facility in use by the Owner at least 2 working days before interruption of the system.
- H. Coordinate installing electrical identification after completion of finishing work where identification is applied to field-finished surfaces.
- I. Where changes in the work, or substitutions in material are proposed, ensure that sizes, weights, openings, etc., are provided that do not require changes in the work outside this Division.
- J. Legally required standby system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent devices per NEC 701.18. Do an engineering coordination study of all overcurrent devices and provide copies for review by the Engineer and retention by Owner.

3.4 INSTALLATION

A. ENCLOSURES FOR USE WITH ELECTRICAL EQUIPMENT

Unless specifically called out otherwise on the Plans, electrical enclosures shall meet the following specification:

1. Dry Areas

NEMA 1.

2. Wet Areas

a. Indoors

NEMA 3R with HVAC equipment.

NEMA 4 where the enclosure will be subjected to splashing water or hose-directed water.

NEMA 12 where the enclosure will not be subjected to splashing water or hose-directed water.

b. Outdoors

NEMA 3R where the enclosure will not be subjected to splashing water, hose-directed water, or windblown dust.

NEMA 4 where the equipment is not HVAC and where the enclosure will be subjected to splashing water, hose-directed water, or windblown dust.

3. Corrosive Locations

NEMA 4X.

4. Exceptions

a. As otherwise indicated on the Plans.

b. As modified in other Division 16 sections.

5. Standards

- a. NEMA ICS-6, Enclosures for Industrial Controls and Systems.
- b. UL 508A, Standard for Industrial Control Panels.
- c. UL 698, Industrial Control Equipment for use in Hazardous Locations.

B. WORKMANSHIP

Install the equipment and materials in accordance with the manufacturer's instructions, the National Electric Code, National Electric Safety Code, applicable local regulations, ordinances, and industry standards. A person in charge at the site shall maintain adequate supervision of the work under this division when necessary for coordination with other work.

C. SELF-SUPPORTED EQUIPMENT

Install self-supporting equipment in a level and plumb manner, shimming with full width stainless steel shims, as necessary. Bolt units to the floor with stainless steel expansion anchors and bolts, or weld units to embedded steel channels. Floor or pad shall be level within plus or minus 1/8 of an inch in a square yard before installing equipment. Grout or caulk enclosure to floor or pad. Provide bushings on conduits entering from above or at the side. For conduits entering from below, install grounded insulating bushings bonded to the ground bus or pad.

Install concrete pads and bases according to requirements of Section 03300.

Provide concrete foundations or pads required for electrical equipment as indicated or specified:

1. Floor-mounted equipment shall be mounted on a 4-inch-high concrete housekeeping pad. Pad shall be poured on top of the finished floor or slab.

D. MOUNTING HEIGHT

Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated. Mount enclosures for individual units at 54 inches above floors to centerline of controls unless otherwise indicated in the Plans.

E. ACCESSIBILITY

Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, while minimizing interference with other installations.

F. EQUIPMENT ORIENTATION

Install items parallel and/or perpendicular to other building systems and components, except where otherwise indicated.

G. EQUIPMENT MOUNTED ENCLOSURES

Attach enclosures mounted on equipment with machine screws or clamps as required. Do not drill equipment frames or sheets without permission of supplier/manufacturer or the Engineer.

Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

H. COORDINATION

Give right of way to raceways and piping systems installed at a required slope.

I. WALL MOUNTED ENCLOSURES

Stand equipment off wall surfaces a minimum of 1/4 of an inch where enclosures are mounted on walls in WET AREAS with neoprene or plastic shim washers.

J. MISCELLANEOUS SUPPORTS

Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices, except where components are mounted directly to a structural member of adequate strength.

K. SLEEVES

Install for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

L. FASTENING

Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure.

1. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.
2. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.

M. FIREPROOFING

1. Do not remove or damage fireproofing materials.
2. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
3. Repair or replace fireproofing removed or damaged.

N. PENETRATIONS

Make all penetrations of electrical work through walls and roofs water and weather-tight.

O. MISCELLANEOUS REQUIREMENTS

1. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.
2. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete.
3. Do not exceed the dimensions indicated for equipment except as approved in writing by the Engineer.

4. Do not use equipment or arrangements for equipment that reduce the required clearance or exceed the space allocations.

P. DIMENSIONS

Dimensions indicated for electrical equipment and dimensions indicated for the installation of electrical equipment are restrictive dimensions.

1. Field measurements take precedence over dimensioned plans.

3.5 IDENTIFICATION

A. LABELS

Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment. Conduit labeling is further described in section 16130. The labeling of conductors is further described in section 16120.

B. NOMENCLATURE

Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated on the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.

C. SELF-ADHESIVE IDENTIFICATION PRODUCTS

Clean surfaces of dust, loose material, and oily films before applying.

D. IDENTIFY PATHS OF UNDERGROUND ELECTRICAL LINES

During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above power and communication lines. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches, use a single line marker.

E. ENGRAVED, PLASTIC-LAMINATED LABELS, SIGNS, AND INSTRUCTION PLATES

Engraving stock shall be melamine plastic laminate punched for mechanical fasteners with a minimum thickness of 1/16 of an inch for signs up to 20 square inches, and 1/8 of an inch thick for larger sizes. Engraved legend in white letters on black face. Provide nameplates on

equipment enclosures giving the name and circuit identification of the enclosed device/equipment in 1/4 of an inch lettering.

F. PANELBOARD SCHEDULES

For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

G. ARC FLASH HAZARD

Provide and install warning labels for arc flash hazard on all switchboards, panelboards, control panels, motor control centers, and other equipment per the requirements of the NEC and Washington State Administrative Code (WAC).

3.6 DEMOLITION

A. EQUIPMENT TO BE DEMOLISHED

Demolish all existing electrical devices and circuits, which are noted for demolition. Demolition includes, but is not limited to:

1. Removing all conduit, conductors, fittings, device boxes, hangers, panels, devices, etc., which are not concealed in the building structure or below grade/slab.

B. TEMPORARY POWER

Provide temporary power to existing branch circuit panels, branch circuits, and/or directly to electrical devices as required to keep all portions of the existing facility, which are occupied by the Owner, or required for operation, in operation at all times. Obtain approval by all appropriate code authorities, including the Department of Labor & Industries Electrical Inspection Department, or the local jurisdiction having authority, for any temporary connections required.

C. DAMAGED ELECTRICAL EQUIPMENT

Where remaining electrical work is damaged or disturbed in the course of the work, remove damaged portions, and install new products of equal capacity, quality, and functionality.

D. ABANDONED WORK

Remove existing conductors from conduits, unless otherwise indicated. Cut and cap buried raceway indicated to be abandoned in place 2 inches below the surface. Cap and patch surface to match existing surface finish.

E. REMOVAL

See section 01900.

F. TEMPORARY DISCONNECTION

Remove, disconnect, store, clean, reinstall, reconnect, and make operational those components that are indicated for relocation and/or reconnection. Coordinate the process, mechanical, HVAC, and other equipment scheduled to be relocated and/or reused with other Divisions.

3.7 CUTTING AND PATCHING

Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.

Repair disturbed surfaces to match adjacent undisturbed surfaces.

3.8 TOUCHUP PAINTING

Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.

Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3.9 EXTRA MATERIALS

Extra materials in this Section cover all spare parts for electrical devices under this contract and are centrally listed here for clarification and completeness. Spares shall match products installed, and shall be packaged with protective covering for storage and identified with labels describing the contents within.

A. GENERATOR ASSEMBLIES (ASSOCIATED CSI SECTION – 16230)

1. Power Fuses (line power)

Provide 3 spare power fuses of each type and rating.

2. Control Fuses

Provide 10 percent (minimum of two) spare control fuses of each type and rating to cover all motor starters (not per starter).

Provide 1 control fuse puller.

3. Filters

Provide two sets each of lubricating oil, fuel, and combustion air filters.

4. V-Belts

Provide one complete replacement set of all V-belts.

5. Touchup Paint

Provide 1 quart (minimum) of touchup paint matching each color utilized on generator set.

6. Provide spare parts in suitable boxed watertight container marked "GENERATOR SPARE PARTS" and deliver to the Owner. Label with supplier's/manufacturer's name, the model number of the generator set, and the 24-hour service telephone number.

B. MOTOR CONTROLLERS (ASSOCIATED CSI SECTION – 16420)

The following quantities cover all motor starters under this contract (quantities are not per starter).

1. Power Fuses (line power)

Provide three spare power fuses of each type and rating.

2. Control Transformer Fuses (primary and secondary)

Provide 10 percent (minimum of two) spare control transformer fuses of each type and rating.

Provide one control fuse puller.

3. Control Fuses

Provide 10 percent (minimum of two) spare control fuses of each type and rating.

Provide one control fuse puller.

4. Control Relays

Provide 10 percent (minimum of two) spare control relays of each type and rating.

5. Control Timing Relays

Provide 10 percent (minimum of two) spare control timer relays of each type and rating.

6. Provide a single latching plastic container with a printed label adhered to the lid stating "MOTOR STARTER SPARE PARTS."

C. PANELBOARDS (ASSOCIATED CSI SECTION – 16440)

1. Cabinet Keys

Provide three spares of each type of key for panelboard cabinet locks.

2. Provide a latching plastic container with a printed label adhered to the lid stating "PANELBOARD SPARE KEYS."

D. CONTROL PANELS (ASSOCIATED CSI SECTION – 16940)

The following quantities cover all control panels fabricated by the fabrication shop (quantities are not per panel).

1. DIN-rail Fused Terminals

Provide five spare DIN-rail fused terminals of each type and rating.

2. DIN-rail Feed-Through Terminals

Provide five spare DIN-rail feed-through terminals of each type, color, and rating.

3. Power Fuses (line power)
Provide three spare power fuses of each type and rating.
4. Control Power Fuses
Provide 10 percent (minimum of two) spare control power fuses of each type and rating.
Provide one control fuse puller.
5. PLC I/O Fuses
Provide 10 percent (minimum of two packets of five fuses each) spare control fuses of each type, voltage, and rating. Fuse ampacity should be clearly shown or marked.
6. PLC Buffer Relays
Provide 10 percent (minimum of four) spare PLC buffer relays of each type, style, and rating.
7. Control and Timing Relays
Provide 10 percent (minimum of four) spare control and timing relays of each type, style, and rating.
8. Control and Timing Relay Sockets
Provide two spare control and timing relay sockets of each type, style, and rating.
9. Intrinsically Safe Barriers
Provide one spare intrinsically safe barrier each type, style, and rating.
10. Ethernet Switches
Provide one spare Ethernet switch of each type.
11. Relay/Solenoid Surge Protective Devices
Provide two spare Metal Oxide Varistors (MOVs) for AC relays and solenoids and two spare diodes for DC relays and solenoids.

12. Provide a single latching plastic container with a printed label adhered to the lid stating “CONTROL PANEL SPARE PARTS.”

E. PLC PROCUREMENT (ASSOCIATED CSI SECTION – 16910)

1. Provide 10 percent (minimum of one) boxed spares of each PLC I/O module, communications module, power supply, and CPU module used in this contract.
2. Provide a single latching plastic container with a printed label adhered to the lid stating “PLC SPARE PARTS.”

F. LIGHTING EQUIPMENT (ASSOCIATED CSI SECTIONS – 16510 AND 16520)

Supply the following extra materials, matching the products installed, in sealed original packaging:

1. Fluorescent and HID Luminaires
 - a. Provide 10 percent spare lamps (minimum of two) of each type and rating.
 - b. Provide two spare ballasts of each type and rating.
2. Fused Luminaires
Provide three spare fuses of each type and rating.
3. Exterior Luminaires:
Provide 5 percent of each type of lens, cover, globe, diffuser, or other optical part. Provide at least one of each type.
4. Luminaire-specific tools:
Provide three spares of any keys or other proprietary tools required to access or service luminaires.
5. Provide spare materials in a single latching plastic container with a printed label adhered to the lid stating “LIGHTING SPARE PARTS.”

3.10 REQUEST FOR INFORMATION

Contractor shall locate all relevant information pertaining to the question prior to submission to the Engineer for review.

The Electrical Contractor shall review and approve all RFIs concerning electrical topics before submission.

3.11 TESTING, THIRD PARTY

Test electrical equipment before energization and placing into service. Report all test results in writing. Where tests disclose a defect in the work, rework, or repair the work at no additional expense to the Owner and retest to confirm the rework or repair until testing confirms that the defect has been corrected. Test in accordance with the manufacturer's installation and testing instructions and the applicable electrical standards (i.e., NEMA, NFPA, IEEE, ISA, ANSI) for the class of equipment

A. THIRD-PARTY CIRCUIT BREAKER TEST

Prior to energization engage an independent electrical testing organization to perform the test below.

1. For molded case circuit breakers 100 Amps and larger, provide an independent testing agency to perform switch tests as stated in NETA ATS, Section 7.5 and circuit breaker tests as stated in NETA ATS, Section 7.6. Certify compliance with test parameters.
2. Provide third party breaker test documents signed by the independent testing agency and the contractor and issued and approved by the Engineer prior to energizing the breaker(s).

These documents shall clearly show and describe the methods and equipment used in the test and all relevant readings and findings and shall include, as a minimum, the following:

- a. All breakers tested shall use the breaker tag numbers as assigned on the Plans.
- b. Each parameter measured shall include the dimension in the measured column (Amps, mΩ, seconds, etc.).
- c. Each parameter measured shall include an associated minimum and maximum acceptable value (acceptable range).

- d. Each breaker shall include a “passed” or “failed” status.
 - e. Failed breakers shall include a short statement describing the failed parameter.
 - f. Each breaker shall include the manufacturer’s associated circuit breaker curve.
3. A copy of these signed test results shall be included in the O&M Manual.
 4. Breakers that fail third party testing shall be replaced with new and retested by the same third-party testing agency. This process shall be repeated until all breakers subjected to this requirement have successfully passed testing and have been documented.

Upon failure of a third-party breaker test, the cost of a new breaker and additional third party testing shall be borne by the device/equipment manufacturer.
 5. These specifications apply to the following Sections if they are included in this contract: 16230, 16410, 16440, 16442.

B. THIRD-PARTY ENGINEERING COORDINATION STUDY

Engage an independent engineering company to perform the study below.

1. Provide a third-party engineering coordination study of all new and existing overcurrent devices. Panelboards shall be excluded from this study. Contractor shall adjust devices as necessary to meet the recommendations of the coordination study. A copy of these signed test results shall be submitted to the Engineer for approval prior to startup and shall be included in the O&M Manual.

C. THIRD-PARTY ENGINEERING ARC FAULT AND SHOCK HAZARD STUDY

Engage an independent engineering company to perform the study below.

1. Provide a third-party engineering study to determine the arc flash levels, shock hazard, and required PPE, at each key piece of electrical equipment including:
 - a. All Motor Control Centers (MCCs)

- b. All panelboards and/or switchboards
 - c. All process control panels listed under UL 508/ UL 508A or similar WA state approved agency.
 - d. All field control panels listed under UL 508/ UL 508A or similar WA state approved agency.
 - e. All manual or automatic transfer switches
 - f. All service entrance devices (SUSE rated) with bonded neutral connections.
2. A copy of these signed test results shall be submitted to the Engineer prior to project completion and shall be included in the O&M Manual.
 3. Provide and install OSHA and NEC compliant labels with the information provided by the study. Labels shall contain the following information as a minimum.

WARNING	
Arc Flash & Shock Hazard Appropriate PPE Required	
FLASH PROTECTION Arc Flash Boundary _____ Hazard Risk Category _____ Incident Energy (cal/cm ²) _____ Corresponding Work Distance _____ _____ VAC Shock Hazard When: Minimum Arc Rating of Clothing _____ Nominal System Voltage _____ PPE: <ul style="list-style-type: none"> <input type="checkbox"/> Arc-rated long sleeve shirt and long pants <input type="checkbox"/> Arc-rated face shield or arc flash suit hood <input type="checkbox"/> Safety glasses or safety goggles <input type="checkbox"/> Hearing protection (ear canal inserts) 	SHOCK PROTECTION Limited Approach Boundary _____ Restricted Approach Boundary _____ Prohibited Approach Boundary _____ PPE: <ul style="list-style-type: none"> <input type="checkbox"/> Class _____ <input type="checkbox"/> V-rating _____ <input type="checkbox"/> _____
PPE: <ul style="list-style-type: none"> <li style="width: 50%;"><input type="checkbox"/> Arc-rated long sleeve shirt and long pants <li style="width: 50%;"><input type="checkbox"/> OR arc-rated coverall <li style="width: 50%;"><input type="checkbox"/> Arc-rated face shield or arc flash suit hood <li style="width: 50%;"><input type="checkbox"/> Leather gloves and shoes <li style="width: 50%;"><input type="checkbox"/> Safety glasses or safety goggles <li style="width: 50%;"><input type="checkbox"/> Hard hat <li style="width: 50%;"><input type="checkbox"/> Hearing protection (ear canal inserts) <li style="width: 50%;"><input type="checkbox"/> Arc-rated hardhat liners AN 	
Equipment ID: _____	
<small>BRADY® #121085 BRADYID.COM Y1894701</small>	

3.12 TESTING NOT REQUIRING THIRD PARTY

Test electrical equipment before energization and placing into service. Report all test results in writing. Where tests disclose a defect in the work, rework, or repair the work at no additional expense to the Owner and retest to confirm the rework

or repair until testing confirms that the defect has been corrected. Test in accordance with the manufacturer's installation and testing instructions and the applicable electrical standards (i.e., NEMA, NFPA, IEEE, ISA, ANSI) for the class of equipment

A. CONDUCTOR MEGGER TEST

1. Power Conductor Testing

After pulling and prior to connection perform a Megger test between all power conductors (including the equipment ground) and between each power conductor and earth ground in the following manner:

- a. Perform megger tests at 600 V.
- b. Record ambient temperature and humidity during testing.
- c. Cables or conductors with a steady-state value less than 100 megohms shall be considered "failed".
- d. Failed cables and conductors shall be removed and replaced with new and retested per these specifications.
- e. Provide a Power Conductor Megger Testing Report. A blank copy of this report, specifically associated with this contract, is available from Engineering on request. A copy of these signed test results shall be submitted to the Engineer for approval prior to startup and shall be included in the O&M Manual.

2. Control Conductor Testing

- a. Control conductor insulation testing is not required.

3. Instrumentation Conductor Testing

- b. Instrumentation conductor insulation testing is not required.

B. CONDUCTOR INSPECTION

On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters.
 - b. Remove and replace conductors with visible insulation damage on conductor ends due to installation in an incomplete or damaged conduit system such as, but not limited to, missing bushings or burrs on conduit ends.

C. MOTOR COMMISSIONING TEST

1. Provide a Motor Commissioning Test Report for each new or refurbished motor. A blank copy of this report, specifically associated with this contract, is available from Engineering on request. Motor Commissioning Test Reports shall be signed by the Contractor and approved by the Engineer prior to energizing the motors. A copy of these signed test results shall be included in the O&M Manual.

D. GROUND TEST

Engage an independent electrical testing organization to perform the test below.

1. Subject the completed GROUNDING ELECTRODE SYSTEM to a 3-point fail-of-potential ground test according to IEEE 81. Perform the test not less than 2 full days after the last trace of precipitation, and without the 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.

Maximum grounding resistance values shall be as listed below:

- a. Equipment Grounding System: 25 ohms.
 - b. Main Service, Grounding Electrode System: 5 ohms.
2. Provide ground test documents signed by the tester and the contractor and issued and approved by the Engineer prior to energizing the power distribution system.

These documents shall clearly show and describe the methods and equipment used in the test and all relevant readings and findings including ground resistance at each test location and observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

These documents shall clearly state whether the system has passed or not passed and show the point(s) where failure occurred. A copy of these signed test results shall be included in the O&M Manual.

3. Where resistance to ground exceeds specified values, notify the Engineer. Check connections of affected equipment and conductors. Replace or repair defective connections or conductors. Provide additional ground rods where the grounding electrode resistance is greater than specified. Revise and repeat testing until resistance is within specifications.
4. These specifications apply to the following Section if it is included in this contract: 16060.

3.13 GENERAL TESTING AND INSPECTION

A. PRIOR TO ENERGIZATION

1. After installing disconnect switches and circuit breakers, perform visual and mechanical inspection of enclosures and devices.
2. Test the equipment and electrical circuits for proper connection, tightness, and absence of undesirable shorts and grounds.
3. Check for continuity, visual damage, marking, and proper phase sequence.
4. Remove any burrs, filings, or other foreign materials from all enclosures; completely wipe down and vacuum.
5. Run a magnet around the bottom of each enclosure and around surfaces that may have collected metal shavings during manufacturing or construction.

B. AFTER ENERGIZATION

1. After electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

2. Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
3. Test operation, calibration, and settings of the meters, relays, and indicating devices.
4. Test all operating controls for proper operation.
5. Test all auxiliary equipment, i.e., heaters, thermostats, lights, all illuminated indicating devices and lamps, and all audible alarm devices which are an integral part of transformers and panels to verify that they function properly.
6. Take load readings on each panelboard after all loads are connected. Record these measurements to give the maximum reading for each phase and neutral obtained with lighting, appliances, motors, and other loads connect to, and operating from, the panels in service.
7. Check fuses with an ohmmeter. Ring out wiring and busing. Check operation of control and safety interlocks. Check grounding of potential transformers, current transformers, and surge protective devices. Check control connections and tightness at terminal blocks, relays, meters, switches, etc. Tug on each connection to verify a tight connection.
8. Check field connections to field devices, PLCs, and motor starters.
9. Verify proper communication reliability and data transfer speed on local networks.
10. Rework or repair equipment, which performs unsatisfactorily during, or as a result of, testing at no additional expense to the Owner.
11. Additional testing requirements specific to other sections are specified in those sections.

C. INSPECTIONS BY THE AHJ

For any situations concerning the AHJ and/or inspections, the Electrical Contractor shall provide a written description of the issue encountered

during inspection, documentation of any field conversation with the AHJ/inspector, and recommendations to rectify the situation.

3.14 TEST DOCUMENTS

Test documents, as described above, shall be signed and submitted to Engineering for review prior to energizing associated electrical circuits.

3.15 DEMONSTRATION

Demonstrate to the Owner that the electrical installation is working by operating all electrical systems and equipment. Simulate control and emergency conditions, artificially where necessary, for complete system tests. Demonstrate equipment in accordance with each section in Division 16.

3.16 CLEANING

Clean dirt and debris from all internal and external surfaces. Vacuum out the interior of electrical panels.

Apply touchup paint as required to repair scratches, etc.

Replace nameplates damaged during installation. Thoroughly vacuum the interior of all enclosures to remove dirt and debris.

***** END OF SECTION *****

SECTION 16060

GROUNDING AND BONDING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes grounding of electrical systems, equipment, and basic requirements for grounding, and protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Sections</u>	<u>Items</u>
01300	Submittals
16050	Basic Electrical Materials and Methods
16120	Conductors and Cables
16130	Raceway and Boxes
WAC 296-46B-250	Grounding and Bonding

1.3 DEFINITIONS

- A. **BONDING JUMPER** (from NEC 2017, Article 100 - Definitions, Bonding Jumper, Main)

The connection between the GROUNDED CIRCUIT CONDUCTOR and the EQUIPMENT GROUNDING CONDUCTOR at the service.

- B. **EQUIPMENT GROUNDING CONDUCTOR** (from NEC 2017, Article 100 - Definitions)

The conductive path installed to connect normally non-current-carrying metal parts of equipment together and to the SYSTEM GROUNDED CONDUCTOR or to the GROUNDING ELECTRODE CONDUCTOR, or both. Code requirements associated with equipment grounding is referenced to NEC 250, Section VI – Equipment Grounding and Equipment Grounding Conductors.

- C. **GROUNDED SERVICE CONDUCTOR**

Also called “utility neutral.” A conductor used to connect the neutral point of the utility transformer to the neutral point of the service entrance.

See SUSE, SYSTEM GROUNDING.

D. GROUNDING ELECTRODE (from NEC 2017, Article 100 - Definitions)

A conducting object through which a direct connection to earth is established.

E. GROUNDING ELECTRODE CONDUCTOR (from NEC 2017, Article 100 - Definitions)

A conductor used to connect the SYSTEM GROUNDED CONDUCTOR or the equipment to a GROUNDING ELECTRODE or to a point on the grounding electrode system.

F. GROUNDING ELECTRODE SYSTEM

See SYSTEM GROUNDING.

G. SUSE

The term SUSE is an acronym for “SUITABLE FOR USE AS SERVICE EQUIPMENT.” It is the point in the electrical grounding system where the SYSTEM GROUNDING CONDUCTORS connect to the EQUIPMENT GROUNDING CONDUCTORS, or the GROUNDED SERVICE CONDUCTOR, or both. For each separately-derived source, this shall occur at the SUSE point. These two points are connected by a BONDING JUMPER.

H. SYSTEM GROUND GRID

The SYSTEM GROUND GRID refers to all portions of SYSTEM GROUNDING. It may be as simple as a pair of ground rods and their associated GROUNDING ELECTRODE CONDUCTORS or a complex ground system with multiple types of GROUNDING ELECTRODES.

I. SYSTEM GROUNDED CONDUCTOR

See GROUNDING ELECTRODE CONDUCTOR.

J. SYSTEM GROUNDING

System Grounding (also referred to as a GROUNDING ELECTRODE SYSTEM) consists of all GROUNDING ELECTRODES, GROUNDING ELECTRODE CONDUCTORS, and associated connecting devices. The GROUNDED SERVICE CONDUCTOR, typically referred to as the

“utility neutral”, is also associated with the system ground. Code requirements associated with system grounding is referenced to NEC 250.50 – Grounding Electrode System.

1.4 SUBMITTALS

Submit under provisions of Section 01300, and Section 16050.

1.5 QUALITY ASSURANCE

See Section 16050.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING PRODUCTS

Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.2 WIRE AND CABLE GROUNDING CONDUCTORS

Comply with Section 16120.

A. EQUIPMENT GROUNDING CONDUCTORS

1. Insulated Conductors

Color coded green, per section 16120.

2. Sized in compliance with NEC Table 250.122 or as shown on the Plans, whichever is larger.

B. GROUNDING-ELECTRODE CONDUCTORS

1. Bare Conductors

Soft drawn stranded copper meeting ASTM B8.

2. Sized in compliance with NEC Table 250.66 or as shown on the Plans, whichever is larger.

C. GROUNDING BRAIDS

1. Copper, manufactured, sized at 26,240 circular mils minimum (#6 AWG equivalent).
2. Certified C22.2, No. 41, Grounding and Bonding Equipment.
3. UL Listings: UL-467 and UL486A.

2.3 GROUND RODS

A. SIZE AND TYPE

1. Ground rods shall be 3/4-inch diameter by 10-feet long unless otherwise stated on the Plans.
2. Ground rods shall be copperclad steel rods as follows:
 - a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
 - b. Corrosion resistant bonding between the copper and steel.
 - c. Hard drawn for a scar-resistant surface.

2.4 GROUND ROD BOX

A. GROUND ROD BOXES

1. Ground rod boxes shall be “Fogtite Ground Rod Box” or equal.

B. GROUND ROD BOX LIDS

1. Ground rods associated with vaults, pullboxes, or handholes that may be subjected to road traffic or heavy loads shall have their ground box lids match the road rating load value of the associated vaults, pullboxes, or handholes.
2. The minimum ground rod box lid shall be rated H20.

2.5 CONNECTOR PRODUCTS

A. COMPRESSION CONNECTORS

1. Compression type for interior locations:
 - a. Standards: UL 467.
 - b. High copper alloy content.
 - c. Non-reversible.
 - d. Terminals for connections to bus bars shall have two bolt holes.
2. Compression type suitable for direct burial in earth or concrete:
 - a. Standards: UL 467, IEEE 837.
 - b. High copper alloy content.
 - c. Non-reversible.

B. BOLTED CLAMPS

1. Standards: UL 467.
2. High copper alloy content.
3. Heavy-duty type.

PART 3 APPLICATION

There are two types of grounding systems covered in this specification;
(1) Grounding Electrode Systems and (2) Equipment Grounding Circuits.

1. Grounding Electrode Systems shall comply, as a minimum, to the requirements of NEC Sections 250.50 through 250.104, including Table 250.66, "Grounding Electrode Conductor for Alternating-Current Systems."
2. Equipment Grounding Circuits shall comply, as a minimum, to the requirements of NEC Sections 250.110 through 250.148, including Table 250.122, "Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment."

3.1 GROUND ROD BOX

The connection of Grounding Electrode Conductors to each ground rod shall be accessible through a ground rod box as described herein.

- A. Each ground rod shall be provided with a separate ground rod box which shall provide access to the ground rod, its Grounding Electrode Conductor, and its associated ground clamp.

Exceptions:

- *Unless specifically stated or detailed otherwise on the Plans.*
- *Ground rod boxes shall not be required if the ground rod is exposed in a manhole, handhole, or seal-off vault as described in this specification.*

- B. Each ground rod box shall be mounted flush to grade.

Exceptions:

- *Unless specifically stated or detailed otherwise on the Plans.*

3.2 GROUNDING ELECTRODE SYSTEMS

Comply with NEC Article 250, Section III for types, sizes, and quantities of Grounding Electrode Conductors, except where specific types, larger sizes, or more conductors than required by NEC are shown on the Plans.

Provide grounding system as shown on the Grounding One Line Diagram of the Plans if provided.

A. GROUNDING ELECTRODE SYSTEM

A GROUNDING ELECTRODE SYSTEM shall have a minimum of two ground rods spaced a minimum of 6 feet apart and connected with Grounding Electrode Conductors as described in this Section.

B. SYSTEM GROUND GRIDS AROUND STRUCTURES WITH CONCRETE FLOORS OR STEM WALLS

A ground grid shall consist of a ring of Grounding Electrode Conductors around a building or structure placed a maximum of 3 feet away from the structure at a minimum depth of 30 inches below grade with its ground

connection established in one of the three following ways: (1) with ground rods; (2) with “concrete-encased electrodes;” or (3) with a combination of both (1) and (2).

When the Plans specifically show, state, or define the method of establishing the SYSTEM GROUND GRID and show the distribution and sizes of the Grounding Electrode Conductors, then these methods shall be followed unless required to be larger by NEC Table 250.66.

When the Plans state that the Contractor may define the method of grounding, then it is left to the Contractor to provide one of the three grounding methods in compliance to NEC and with the approval of the Electrical Engineer and the Electrical L&I Inspector. Regardless of the method used, the Contractor is responsible to provide and meet the testing requirements in QUALITY CONTROL in this Section.

1. Establishing a SYSTEM GROUND GRID with Ground Rod Electrodes
 - a. Ground rods shall be placed at each of the major corners of the structure. If a structure has an irregular shape with corners spaced more than 10 feet apart, than a ground rod shall be placed at that corner.

2. Establishing Ground with “Concrete-Encased Electrodes”

A “concrete-encased electrode” ground system shall be allowed only if the building or structure is provided with a new concrete floor in direct contact with the earth and meets or exceeds the requirements of NEC Section 250.52.

- a. Attach a separate Grounding Electrode Conductor from the SYSTEM GROUND GRID to the foundation rebar in each of the four corners of the building or structure minimum.

C. RESERVOIR GROUNDING ELECTRODE SYSTEM

Reservoir Grounding Electrode Systems shall consist of:

1. A ring of #2 AWG grounding electrode conductors 180 degrees around the reservoir placed a maximum of 3 feet away from the concrete ringwall at a minimum depth of 30 inches below grade with its ground connection established with four grounding rods in ground rod boxes spaced 45 degrees apart symmetrically centered

to the centerline of the tank as shown in Figure 3.2.B-1. The ground grid shall be referred to as the “reservoir ground grid”.

2. Provide two ground connections between the “reservoir ground grid” and the reservoir’s concrete ringwall rebar, with #2 AWG grounding electrode wire spaced 90 degrees apart as shown in Figure 3.2.B-1.

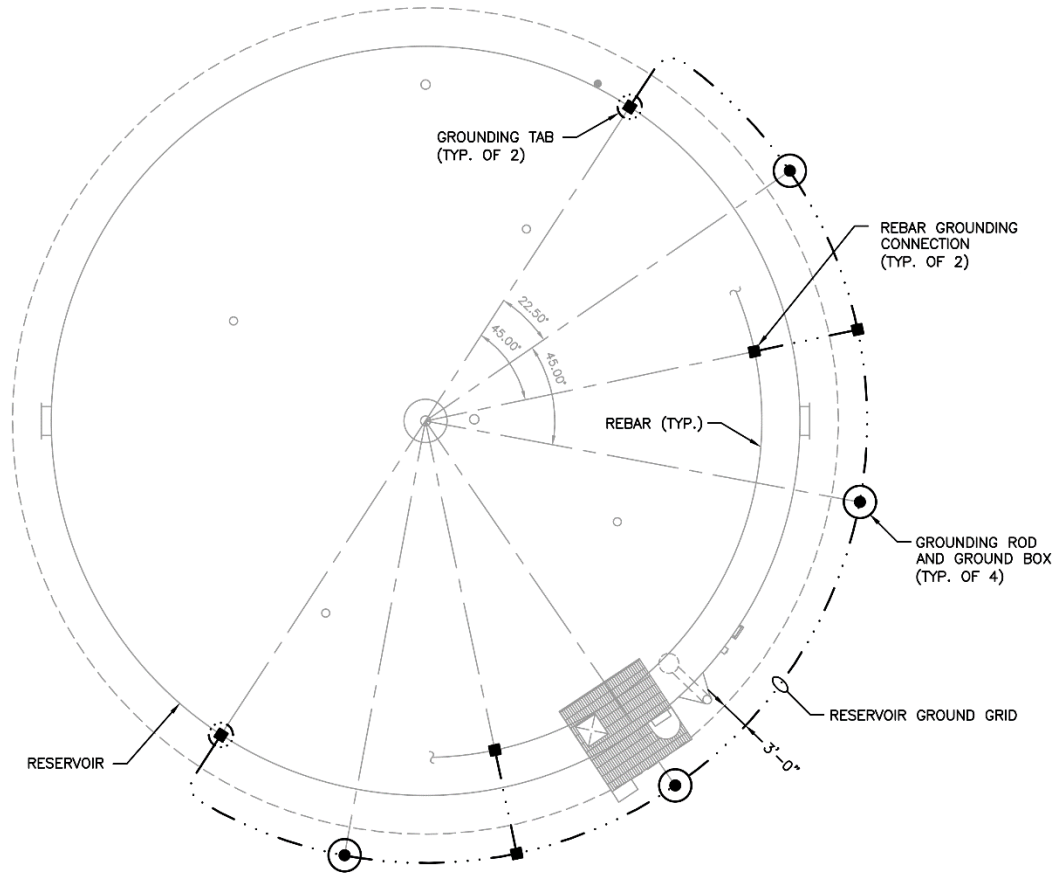


Figure 3.2.B-1

Typical “Reservoir Ground Grid”

3. For Steel Tanks
 - a. Provide two welded steel plate grounding tabs at two opposite points on the tank, 12 to 24 inches above the tank base bolts (reference Figure 3.2.B-2).
 - b. Paint the tabs to match the tank.

- c. Properly clean-to-metal the portions of the tabs that will be used to make electrical contact with the ground lugs.
- d. Connect to the ground lugs with appropriate bonding compound and coat the finished connection to maintain circuit component integrity.
- e. Connect the tabs to the “reservoir ground grid” with #2 AWG grounding electrode wire.

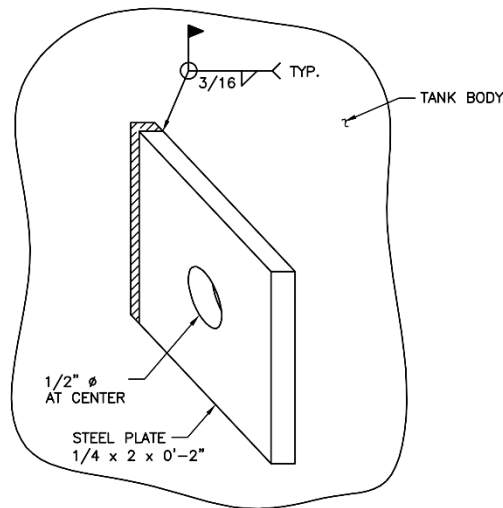


Figure 3.2.B-2

Typical Reservoir Ground Tab

D. VAULT AND PULLBOX GROUNDING

- 1. Provide a SYSTEM GROUND GRID at Pullboxes and Equipment Vaults in compliance with ground conductors sized per NEC Table 250.66 unless shown larger on the Plans. The minimum grounding electrode conductor size shall be #6 AWG.
- 2. Install grounding around and inside the vaults as described in **INSTALLATION; VAULT AND PULLBOX SYSTEM GROUNDING** in Part 4 herein.

E. MANHOLE, HANDHOLE, AND SEAL-OFF VAULT GROUNDING

- 1. Provide a ground rod inside each manhole that contains metal parts.

2. Install grounding around and inside Manholes, Handholes, and Seal-Off Vaults as described in **INSTALLATION; MANHOLE, HANDHOLE, AND SEAL-OFF VAULT SYSTEM, GROUNDING** in Part 4 herein.

F. OTHER GROUNDING ELECTRODE DEVICES AND METHODS

1. Hydraulic Piping Systems

- a. Provide and connect a Grounding Electrode Conductor pigtail to metal hydraulic piping on each major riser. Connect the conductors to the pipe using NEC-approved hardware and methods.
- b. Provide a ground jumper across both sides of a hydraulic piping electrical insulator to continue ground continuity past the insulator.

Exceptions:

- i. *Unless specifically stated or detailed otherwise on the Plans.*
- c. Ground shall be derived from:
 - i. SYSTEM GROUND GRID
 - ii. System SUSE connection point.

2. Magnetic Flow Meters

- a. Provide and connect a Grounding Electrode Conductor to the flow meter manufacturer's ground rings as per the manufacturer's recommendations. Provide a #6 AWG ground conductor unless shown otherwise on the Plans.

Exceptions:

- *Unless manufacturer provides documentation verifying that ground rings are not required.*

3. Generators

- a. In addition to the equipment ground provided with the generator feeder, provide a grounding electrode conductor

to the generator's neutral terminal sized per the Plans or per NEC Table 250.66, whichever is larger. Treat this conductor as a neutral wire.

b. Grounding Methods

- i. The Grounding Electrode Conductor shall be connected to the neutral terminal of the generator as a neutral. This conductor shall be connected to the grounding system at the SUSE bonding connection.

If required to run through a transfer switch, then this neutral wire shall terminate at the transfer switch's isolated neutral bus before continuing to the SUSE bonding point.

- ii. The Equipment Grounding Conductor shall be connected to the metal frame of the generator in compliance with NEC.250.110.

4. Separately Derived Sources

- a. Ground step-down power transformer secondary neutral "XO" terminals to Grounding Electrode Conductors.
- i. System Ground Grid
- b. Ground step-down power transformer secondary neutral "XO" terminals to Grounding Electrode Conductors.

3.3 EQUIPMENT GROUNDING

Comply with NEC Article 250, Section VI for sizes of Equipment Grounding Conductors, except where specific larger sizes are shown on the Cable and Conduit Schedule in the Plans.

A. EQUIPMENT GROUNDING CIRCUITS

Install insulated Equipment Grounding Conductors with circuit conductors in the manner listed below and in compliance with Code.

1. Service and Feeders.

Bond the Equipment Grounding Conductor to the equipment to which the circuit connects and to the raceway if it is metallic.

2. Single-phase motor or appliance branch circuits.
3. Three-phase motor or appliance branch circuits.
4. Flexible raceway runs.

B. EQUIPMENT GROUNDING CONDUCTORS

Equipment Grounding Conductors shall be insulated and color-coded green.

C. ISOLATED GROUNDING-RECEPTACLE CIRCUITS

Install a separate insulated Equipment Grounding Conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at the Equipment Grounding Conductor terminal of the applicable derived system or service, except as otherwise indicated.

D. NONMETALLIC RACEWAYS

Install an Equipment Grounding Conductor in nonmetallic raceways unless they are designated for telephone or data cables. Bond the conductor at each end to grounded metallic raceway or equipment.

E. METALLIC RACEWAYS

Install grounding bushings at the end of each conduit and connect to the equipment ground or GROUNDING ELECTRODE SYSTEM.

F. WATER HEATER, HEAT-TRACING, AND ANTIFROST HEATER CIRCUITS

Install a separate Equipment Grounding Conductor to each electric water heater, heat-tracing assembly, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

G. CONTROL PANELS WITH A PLC

Provide an insulated Equipment Grounding Conductor from the panelboard ground bus directly to a block of isolated ground terminals in the control panel. These terminals shall not be connected to the control panel's chassis ground. This ground shall be considered "Clean Ground" and

shall be dedicated to the termination of instrument cable shields. This “clean” ground shall be #10 AWG minimum.

3.4 FREE-STANDING ELECTRICAL SUPPORT STRUCTURES

Metal support structures used to support electrical equipment, devices, cabinets, panels, or enclosures shall be connected to the GROUNDING ELECTRODE SYSTEM by Grounding Electrode Conductors sized as shown on the Plans or per NEC Table 250.66, whichever is larger. Provide a ground conductor to each vertical support member within 6 inches after rising out of the concrete pad.

3.5 METAL FRAME BUILDING AND SIMILAR STRUCTURES

The metal frame of a building, metal roofs, and other large metal surfaces on buildings shall be bonded to the grounding electrode conductor sized in accordance with NEC Table 250-66. Use a heavy-duty clamp or lug bolted to the metal. Welded metal frame members will be considered to be bonded together. Bolted metal frame members will be considered bonded together under all of the following conditions:

- A. Members are cleaned and a conductive corrosion inhibitor is applied between the mating surfaces.
- B. Bolts are fully torque.
- C. It is proved that from no point on the framework there is more than 5-ohms measured from it to the attachment point of the grounding electrode.

PART 4 EXECUTION

4.1 INSTALLATION

A. GROUNDING ELECTRODE CONDUCTORS IN RACEWAYS

- 1. GROUNDING ELECTRODE CONDUCTORS shall not be installed in metallic raceway. Where required to be in raceway, use PVC-Schedule 80 unless shown otherwise on the Plans. Reference Specification Section 16130.

Ground electrical systems and equipment according to NEC requirements, except where Plans or Specifications exceed NEC requirements.

Coordinate grounding connections made to the water system with the mechanical work and install bonding jumpers wherever deemed necessary.

B. VAULT AND PULLBOX SYSTEM GROUNDING

1. Grounding Outside the Structure

- a. Provide a minimum of one ground rod on the outside of the structure.
- b. Provide a ground rod box over each ground rod with the same rod rating of the pullbox/vault lid.
- c. Space the SYSTEM GROUND GRID a minimum of 12 inches from the edge of the vault.
- d. Connect the vault/pullbox SYSTEM GROUND GRID to the main SYSTEM GROUND GRID with Grounding Electrode Conductor sized per NEC Table 250.66 unless shown larger on the Plans. The minimum conductor size shall be #6 AWG.

2. Grounding Inside the Structure

Reference Figure 4.1.B. In this section, the term “vault” shall apply to both pullboxes and equipment vaults.

- a. Provide a Grounding Electrode Conductor into the vault at one of the four corners. Seal the penetration with non-shrink grout.
- b. Continue the Grounding Electrode Conductor up one corner to 3 - 6 inches below the vault ceiling. Loop the Grounding Electrode Conductor around the vault at this height, on all walls containing a junction box, cable tray, ladder, or other metallic equipment, securing to the vault walls each 24 inches with 316L stainless steel clamps, lag bolts, and fasteners.
- c. Extend a Grounding Electrode Conductor to one of the top mounting bolts of each junction box, cable tray, permanent ladder, or other metallic equipment.
- d. For vaults with metallic hatch lids, provide a grounding braid from the Grounding Electrode Conductor to the hatch lid, sized per NEC Table 250.122 minimum. Provide the braid on the hinged side, sufficiently long to allow a complete 180 degree opening of the hatch lid without

tension on the braid. For vaults with dual lids, connect grounding braids to both hinged sides.

- e. Ground hydraulic piping near its points of entry into, and exit out of, the vault.
- f. Ground manufacturer's instrumentation devices inside the vault per the manufacturer's recommendations.

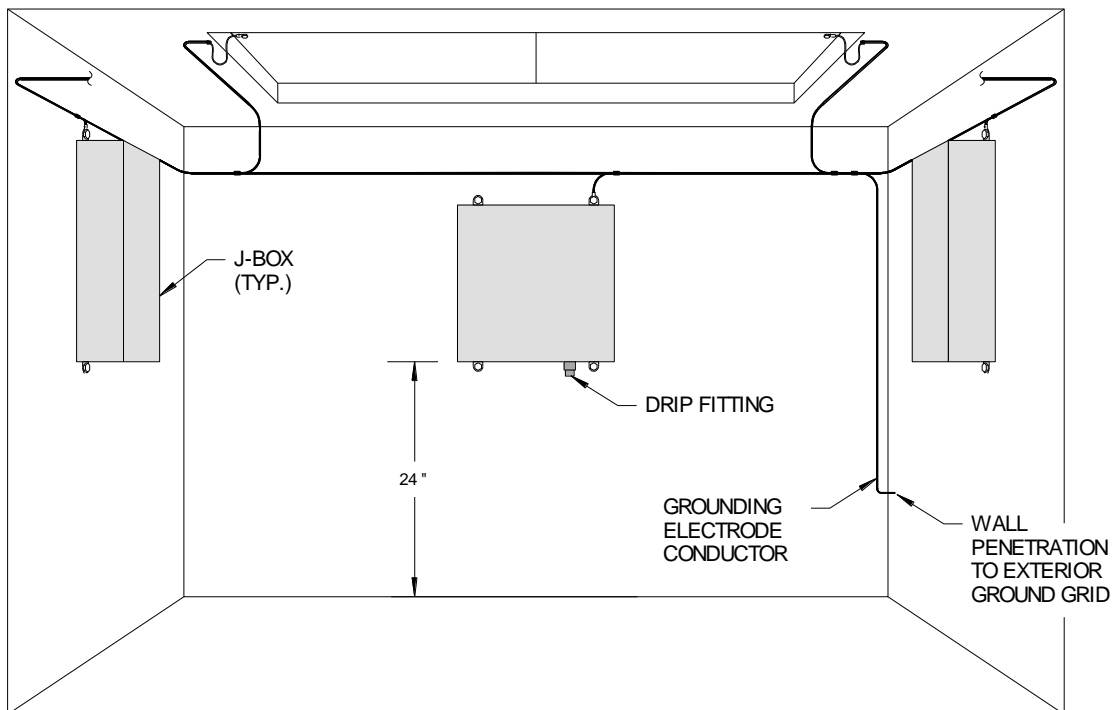


Figure 4.1.B

Vault and Pullbox Internal Grounding

- C. **MANHOLE, HANDHOLE, AND SEAL-OFF VAULT SYSTEM GROUNDING**
 - 1. Provide a ground rod inside each handhole that contains metal parts.
 - 2. Expose a minimum of 4 inches of the ground rod above the floor for field inspection and connections to the rod.
 - 3. Connect the manhole/handhole/seal-off vault **SYSTEM GROUND GRID** to the main **SYSTEM GROUND GRID** with Grounding Electrode Conductors sized per NEC Table 250.66 unless shown

larger on the Plans. The minimum conductor size shall be #6 AWG.

4. Connect the Grounding Electrode Conductor to each metal lid with braided ground conductors of equivalent size and ampacity of the ground ring. Connect braid to metal lids as per manufacturer's recommendations.
5. Connect the Grounding Electrode Conductor to each metal device (conduits, cable tray, j-boxes, support structures, etc.).

4.2 CONNECTIONS

A. GENERAL

Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to the contact surfaces.

B. EQUIPMENT GROUNDING-WIRE TERMINATIONS

Make the grounding conductor connections to motors or equipment 10 hp and above or 20 amperes and above, with conductor termination and a 5/16 of an inch minimum bolt tapped to the motor frame or equipment housing. Ground connection to smaller motors and equipment may be made by fastening the conductor termination to a connection box.

C. METAL RACEWAY TERMINATIONS

Where metallic raceways terminate at metallic or non-metallic enclosures, panels, or housings, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous

conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

D. CONNECTION TORQUE

Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

E. COMPRESSION-TYPE CONNECTIONS

Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

4.3 QUALITY CONTROL

A. TESTS

1. Provide ground testing per Specification 16050, Section 3.

***** END OF SECTION *****

SECTION 16120

CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes building wires, cables, and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods
RCW 19.28.261	Revised Code of Washington, Exemptions from RCW 19.28.161 through RCW 19.28.271
16940	Control Panels

1.3 SUBMITTALS

See Section 01300.

Indicate Field Test Reports and interpret their results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

See Section 16050.

PART 2 PRODUCTS

2.1 BUILDING WIRES AND CABLES

A. STRANDING

1. All power, control, and instrumentation conductors larger than #20 AWG shall be stranded.
2. All equipment ground conductors larger than #16 AWG shall be stranded.
3. All grounding electrode conductors larger than #10 AWG shall be stranded.

B. POWER AND CONTROL WIRE

All power and control wire and conductors in raceways shall be rated 600 VAC.

1. XHHW, XHHW-2

a. Conductor

Class B, stranded, annealed, uncoated copper. Conductors shall comply with:

- i. UL Standard 44.
- ii. ASTM-B3, ASTM-B8, and ASTM-B7B8.

b. Insulation

Cross-Linked Polyethylene (XLP) High Heat Water Resistant. Insulation shall comply with:

- i. UL-83 Thermoplastic-Insulated Wires and Cables.
- ii. UL-1063 Machine-Tool Wires and Cables.

c. The cable shall meet the following Standards and Agency approvals:

- i. NEMA WC70/ICEA S-95-658.
- ii. ASTM Stranding Class B3, B8, B7B8
- iii. Federal Specification A-A-59544

2. THHN, THWN, THHN/THWN-2

a. Conductor

Copper, annealed, uncoated. Conductors shall comply with:

- i. ASTM-B3, ASTM-B8, and ASTM-B7B8.

- b. Insulation

Polyvinyl Chloride (PVC), Nylon jacket. Insulation shall comply with:
 - i. UL-83 Thermoplastic-Insulated Wires and Cables.
 - ii. UL-1063 Machine-Tool Wires and Cables.
 - c. The cable shall meet the following Standards and Agency approvals:
 - i. NEMA WC70/ICEA S-95-658.
3. MTW (Machine Tool Wiring)
- a. Conductor

Copper, annealed, uncoated. Conductors shall comply with:
 - i. ASTM-B3, ASTM-B8, and ASTM-B7B8.
 - b. Insulation

Polyvinyl Chloride (PVC). Insulation shall comply with:
 - i. UL-83 Thermoplastic-Insulated Wires and Cables.
 - ii. UL-1063 Machine-Tool Wires and Cables.
 - c. The cable shall meet the following Standards and Agency approvals:
 - i. NEMA WC70/ICEA S-95-658.
 - ii. UL Standard UL 83, UL 1063, UL 758 cUL file: E156879 and E123744
 - iii. AWM Specification 1316, 1317, 1318, 1319, 1320, 1321
 - iv. ASTM Stranding Class B3, B8, B7B8
 - v. Federal Specification A-A-59544

vi. CSA 22.2 No. 75, UL E156879 and E123744

4. VFD CABLES

The VFD cables shall be 3-conductor with 3 bare copper symmetrical ground wires in XLPE insulation, dual 100 percent copper tape shielding, UL rated at 1,000 V, direct burial, 90C, wet/dry rated, in a sunlight- and oil-resistant PVC jacket (Beldon Series 295xx, or equivalent).

- a. Conductor: Copper, tinned.
- b. Insulation: XHHW-2 or RHW-2 rated.
- c. The cable shall meet the following certifications:
 - i. Mine Safety & Health Administration (MSHA) standards.
 - ii. Suitable for use in Class I & II; Division 2 hazardous locations.
- d. The cable shall meet the following Standards and Agency approvals:
 - i. 1000 V UL 1277, Type TC-ER
 - ii. 1000 V CSA AWM I/II, A/B FT4

C. INSTRUMENTATION, COMMUNICATION, AND NETWORKING CABLES

All instrumentation, communication, and networking cables and conductors in raceway shall be rated 600 VAC.

Exceptions:

- *Telephone cables.*
- *Antenna cables.*
- *Fiber optic cables.*

1. Analog Instrument Cables

Paired and triad analog instrument cables shall be #18 AWG stranded tinned copper 600 V tray cable, rated for wet applications at 75 degrees C in a sunlight resistant PVC jacket. Cables shall be plenum and direct burial rated, and shall be provided with individual pair/triad isolated 100 percent foil shields with independent drain wires and an overall isolated shield with drain wire.

These cables shall also be used for totalizing pulse signals from flow meters.

The following cables shall be used for multiple conductor applications:

- a. 2-Conductor, 1 twisted pair, 100 percent overall shield. Belden #9341 or #1120A or equivalent.
- b. 3-Conductor, 1 twisted triad, 100 percent overall shield. Belden #1121A or equivalent.
- c. 4-Conductor, 2 twisted pairs, 100 percent individual shields plus 100 percent overall shield. Belden #1048A or equivalent.

2. Ethernet Copper Cables

Ethernet cables shall be 600 V, bonded pair, shielded.

- a. Enhanced Category 6 (6e).
 - i. 600 V, polypropylene insulation, with inner PVC jacket and Industrial Grade, Sunlight and Oil Resistant, Black, PVC outer jacket.
 - ii. 8-Conductor, 4 twisted bonded pairs, #23 AWG, solid bare copper, 100 percent overall foil shield.
 - iii. 19.8 dB attenuation per 100 meters at 100 MHz.
 - iv. Belden #7953A or equivalent.

- b. Enhanced Category 5 (5e).
 - i. 600 V, polyolefin insulation, with inner PVC jacket and Industrial Grade, Sunlight and Oil Resistant, Black, PVC outer jacket.
 - ii. 8-Conductor, 4 twisted bonded pairs, #24 AWG, solid bare copper, 100 percent overall foil shield plus 70 percent overall braided tinned copper shield.
 - iii. 22.0 dB attenuation per 100 meters at 100 MHz.
 - iv. Beldon #7957A or equivalent.

3. Enhanced Category 5 (5e) and 6 (6e) RJ45 cable plugs

RJ45 cable plug connectors shall be 8-wire, 10 – 10000 Mbit/sec with metal housing and FC connection technology.



Siemens P/N 6GK1901-1BB12-2AA0 or equal.

4. DeviceNet Cables

DeviceNet cables shall be 2x #16 AWG Power Pair plus 2x #18 AWG data pair, stranded copper, 600 V, 75 C, 100 percent individual shield plus 65 percent overall braided shield.

- a. 600 V, 75 C, Gray Sunlight/Oil-Resistant PVC jacket.

- b. 2-Conductor, 1 twisted pair, #16 AWG, PVC-Nylon insulated, stranded copper power conductors with 100 percent foil shield with common foil drain wire.
- c. 2-Conductor, 1 twisted pair, #18 AWG, F-R Polypropylene insulated, stranded copper data conductors with 100 percent foil shield with common foil drain wire.
- d. 65 percent tinned copper overall braided shield.
- e. Beldon #7896A or equivalent.

5. Profibus Cables

Profibus cables shall be #22 AWG, solid bare copper, 600 V, FHDPE insulation, 100 percent foil shield plus a 65 percent tinned copper braid shield, in a sunlight resistant PVC jacket.

Profibus cables shall comply with:

EU Directive 2000/53/EC (ELV),
 EU Directive 2002/95/EC (RoHS),
 EU Directive 2002/96/EC (WEEC),
 EU Directive 2003/11/EC (BFR),
 CA Prop 65

- a. 600 V, 75 C, Cellular Polyolefin Insulation, Violet jacket.
- b. 100 percent overall foil shield with drain wire plus 65 percent tinned copper braided shield.
- c. 2-Conductor, 1 twisted pair, #22 AWG, solid bare copper.
- d. Beldon #3079A or equivalent.

6. Fiber Optic Cables

Fiber cables shall comply with:

EU Directive 2000/53/EC (ELV),
 EU Directive 2002/95/EC (RoHS),
 EU Directive 2002/96/EC (WEEC),
 EU Directive 2003/11/EC (BFR),
 CA Prop 65

a. Single Mode Cables

Single mode fiber optic cables shall be loose tube, buffered, outside and riser rated, suitable for underground conduit, maximum attenuation at 1310 nm = 0.5 dB/km, maximum attenuation at 1550 nm = 0.5 dB/km.

6-Strand: Belden #B9W510T or equivalent.

12-Strand: Belden #B9W511T or equivalent.

b. Multi-Mode Cables

Multi-mode fiber optic cables shall be loose tube, buffered, outside and riser rated, suitable for underground conduit. Maximum attenuation at 850 nm = 3.5 dB/km, maximum attenuation at 1310 nm = 1.2 dB/km.

i. 62.5 μ m (OM1):

6-Strand: Belden #B9B510T or equivalent.

12-Strand: Belden #B9B511T or equivalent.

ii. 50 μ m (OM2):

6-Strand: Belden #B9A510T or equivalent.

12-Strand: Belden #B9A511T or equivalent.

D. CONTROL AND POWER CABLE/CORDS

1. HVAC Cables

HVAC cables shall only be used as control cables between HVAC equipment and thermostats or other controlling devices.

a. 4-Conductor, #16 AWG, stranded, 600V, tinned copper, cabled, PVC insulation, and PVC jacket. Belden #8620 or equivalent.

b. 5-Conductor, #16 AWG, stranded, 600V, tinned copper, cabled, PVC insulation, and PVC jacket. Belden #9620 or equivalent.

- c. 9-Conductor, #16 AWG, stranded, 600V, tinned copper, cabled, PVC insulation, and PVC jacket. Beldon #9621 or equivalent.
 - d. 12-Conductor, #16 AWG, stranded, 600V, tinned copper, cabled, PVC insulation, and PVC jacket. Beldon #8622 or equivalent.
2. Power Cords
- a. Type SO, 600 Vac, size #14 or larger.
3. Specialty Wire
- As shown specifically on the Plans.

E. CONTROL AND INSTRUMENTATION CABLE CONNECTORS

1. Open Cable to Enclosure Connectors

Open cable to enclosure connectors for interior and exterior applications shall be 316 stainless steel control receptacle cord connector sets: Panel Receptacle = Turck #P-RKV series; field cable termination plug = Turck #P-RSV series. Provide separate pins for each cable shield.

2.2 SPLICES, TAPS AND TERMINAL BLOCKS

Splices are only allowed under the conditions of Section 4.2.E.

A. SPLICES TO POWER CONDUCTORS

1. Splices in Outdoor Areas, Handholes, Vaults, or Direct Buried

- a. For inline butt splices, use inline resin splice kits for non-shielded cables, 600 V; 3M Scotchcast 82-A series or equal. UL listed 486D.
- b. For odd-shaped and odd sized splices, use multi-mold resin splice kits for non-shielded cables, 600 V; 3M Scotchcast 85-14CP or equal. UL listed 486D

2. Indoor Splices and Taps for Receptacles and Lighting
 - a. Use quick spin, wing torque Electrical Spring and Grounding Connectors; 3M 312, 412, 512, and 512G or equal.
3. Motor Lead Connectors
 - a. Motor terminal connectors shall be insulated multiple tap connectors rated for 600 Vac; N.S.I. Polaris or equal.
4. Power Terminal Blocks
 - a. All power terminals shall be 600 Vac, suitable for 75 degrees C rated copper conductor.
 - b. Power terminal blocks may be copper or aluminum and shall have a short circuit current withstand rating following the guidelines described in UL 1059 and shall meet or exceed the available bolted fault current at the point of application.

B. SPLICES TO CONTROL CONDUCTORS

1. In Junction Boxes and Handholes

Splices to control conductors in junction boxes and handholes shall be made with 600 V, UL486D certified, water-proof direct bury connectors with strain relief, pre-filled with waterproof and corrosion-proof, non-hardening, silicone dielectric sealant; DRYCONN DBSR Series or equal.

2. In Pull Boxes

- a. For inline butt splices, use inline resin splice kits for non-shielded cables, 600 V; 3M Scotchcast 82-A series or equal. UL listed 486D.
- b. For odd-shaped and odd sized splices, use multi-mold resin splice kits for non-shielded cables, 600 V; 3M Scotchcast 85-14CP or equal. UL listed 486D.

3. Terminal Blocks in Panels

Reference Specification 16940 for terminations in Control Panels.

C. SPLICES TO INSTRUMENTATION CABLES AND CONDUCTORS

1. In Junction Boxes

Strip back the cable outer sheath exposing cable conductors and shield lengths to 1-inch or less. Twist the wires together and solder. Insert and engage into 600 V, UL486D certified, water-proof connectors, pre-filled with waterproof and corrosion-proof, non-hardening, silicone dielectric sealant; DRYCONN Aqua Series or equal.

2. In Pull Boxes and Handholes

Instrument cables and conductors are always passed through a junction box inside pull boxes and handholes. Reference “In Junction Boxes” (above) and Specification 16130, Section 4.

3. Terminal Blocks in Panels

Reference Specification 16940 for terminations in Control Panels.

2.3 INSULATING MATERIALS

A. ELECTRICAL INSULATION PUTTY

Scotchfill, or equal.

B. INSULATING ELECTRICAL TAPE

7 Mil/0.18 mm Plasticized PVC, rubber-based adhesive, 200 percent elongation, 26 N/cm tensile strength, 8 kV breakdown voltage, meeting CE, CSA, UL certifications.

C. CONDUCTOR COLOR-MARKING TAPE

7 Mil/0.18 mm Plasticized PVC, rubber-based adhesive, 200 percent elongation, 26 N/cm tensile strength, 8 kV breakdown voltage, meeting CE, CSA, UL certifications, in required color.

D. ELECTRICAL HEAT SHRINK TUBING

Heat shrink tubing shall be dual-wall polyolefin, 3-1 shrink ratio, 600 Vac, -55 to 110 degrees C operating range meeting UL 224 600V, 125 degrees C.

PART 3 APPLICATIONS

3.1 WIRE APPLICATIONS

A. CABLE AND CONDUIT SCHEDULE

The Cable and Conduit Schedule shall be considered absolute. No changes to wire sizes, wire count, insulation type, or circuit type shall be allowed without approval from the Engineer.

B. WIRES IN RACEWAYS

Wires installed in raceways shall be considered "FIELD" wiring and shall be installed and terminated by qualified and licensed electrical contractors.

Exceptions:

- *Installation and termination may be by the owner under the provisions of "RCW 19.28.261, Exemptions from RCW 19.28.161 through RCW 19.28.271."*
- *If the raceway is installed inside a control panel fabricated by a certified UL 508 shop, then these wires may be installed and terminated per the provisions of WIRES IN CONTROL PANELS as listed below.*

1. Power Wire

a. Insulation

All service, feeder, and branch circuit conductors shall be XHHW-2.

Exceptions:

- *Unless called out otherwise in the Cable and Conduit Schedule.*
- *Unless approved in writing by the Electrical Engineer.*
- *Unless both ends of wire are installed in the same control panel.*

2. Class 1 and 2 Control Wire

a. Insulation

All control circuits in raceways shall be XHHW-2.

Exceptions:

- *Unless called out otherwise in the Cable and Conduit Schedule.*
- *Unless approved in writing by the Electrical Engineer.*

b. Minimum control wire size in conduits and raceways

The minimum control wire size in conduits and raceways shall be #14 AWG.

C. WIRES IN CONTROL PANELS

Wires in control panels are those that are terminated within a control panel, and do not extend beyond the control panel enclosure. Wires that extend beyond the control panel enclosure shall be installed and terminated per the provisions of “WIRES IN RACEWAYS,” above.

1. Control Panel Power and Control Wire

a. Insulation

Power and control conductors in control panels shall be MTW or THHN/THHN-2.

b. Wires shall have the following minimum sizes and colors:

Circuit Type	Wire Size⁽¹⁾	Wire Color
120 VAC Power Circuits		
120 VAC, Line	#14 AWG	Black
120 VAC, Neutral	#14 AWG	White
120 VAC, Equipment Ground	#14 AWG	Green
120 VAC Control Circuits		
120 VAC, Line	#18 AWG	Black
120 VAC, Neutral	#18 AWG	White

Circuit Type	Wire Size⁽¹⁾	Wire Color
Low-Voltage AC Control Circuits		
Low-Voltage, Line	#18 AWG	Red
Low-Voltage, Neutral	#18 AWG	White
24 VDC Power Circuits		
+24 VDC Power	#14 AWG	Blue
24 VDC Common	#14 AWG	White with Blue stripe
24 VDC Equipment Ground	#14 AWG	Green
Isolated (Shield) Ground	#12 AWG	Yellow with Green stripe ⁽²⁾
24 VDC Control Circuits		
+24 VDC Control	#18 AWG	Blue
24 VDC Common	#18 AWG	White with Blue stripe
PLC I/O Circuits		
DC I/O	#18 AWG ⁽³⁾	Purple
DC I/O Common	#18 AWG	White with Purple stripe
Analog Inputs	#18 AWG	Analog Instrument Cable ⁽⁴⁾
Analog Outputs	#18 AWG	Analog Instrument Cable

Notes:

- (1) Wire sizes are minimums; size wires to comply with NEC and UL 508.
- (2) Isolated (Shield) ground wires shall be of a color scheme that is approved for ground wires but distinct from equipment grounds.
- (3) For PLC digital outputs, conductors may be #18 AWG between the PLC output terminal and the buffer relay coil when fused at not more than 5A. Wiring from the buffer relay output contacts to field terminals shall be #14 AWG minimum. For retrofit panels without buffer relays, digital output wiring shall be #14 AWG.
- (4) Contractor shall provide one of the Analog Instrument Cables described in the "PRODUCTS" section of this specification.

2. Where panels are required to be manufactured and certified to a particular standard (such as UL 508A), the contractor shall substitute wire colors where required to meet the standard.

D. CONDUCTORS DIRECT BURIED

Refer to the Plans for specifications regarding directly buried conductors and cables.

E. POWER CORDS

SO power cords shall be allowed in control panels for circuits not greater than 120 Vac or 48 Vdc. Such applications require installation by a UL 508 shop.

F. SPECIALTY WIRE

Refer to the Plans for specifications regarding “Specialty Wire”.

PART 4 EXECUTION

4.1 EXAMINATION

Examine raceways and surfaces receiving wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

4.2 INSTALLATION

A. GENERAL INSTALLATION METHODS

1. Install wires and cables in raceway system, according to manufacturer’s written instructions and NECA’s “Standard of Installation,” after raceway system is complete.
2. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.
3. Install cables and conductors neatly in all enclosures. Bend or form wires in neat runs from conduits to terminals. Arrange wires so that they may be grouped by conduit or function in the enclosure. Install cable ties and straps to support and bundle wires in enclosures. Arrange wires to allow wire tags and numbers to be easily read without bending or flexing wiring.
4. Leave 6 inches or more of free conductor at each connected device or equipment terminal and 9 inches of free conductor at each unconnected outlet. Tape free ends of conductors at unconnected outlets and coil neatly in outlet box.

5. Install wiring to equipment neutral and grounding blocks on the bottom or furthest back row first. Leave unconnected blocks accessible for future neutral or grounding connections.
6. Provide individual neutral conductors for each associated circuit. Common neutral conductors for multi branch circuits are not permitted.
7. All power distribution raceways shall contain at least one continuous copper grounding conductor with a minimum size as per NEC 250.122. Larger sizes shall be used if identified in the Cable and Conduit Schedule on the Plans.

B. CONDUCTORS SHARING RACEWAYS

1. Power conductors shall not be run in the same raceway with control conductors.

Exception:

- *Unless specifically shown otherwise in the Cable and Conduit Schedule.*

2. Power conductors shall not be run in the same conduit or raceway with instrumentation cables/conductors.
3. Control conductors shall not be run in the same conduit or raceway with instrumentation cables/conductors.

Exception:

- *Unless specifically shown otherwise in the Cable and Conduit Schedule.*

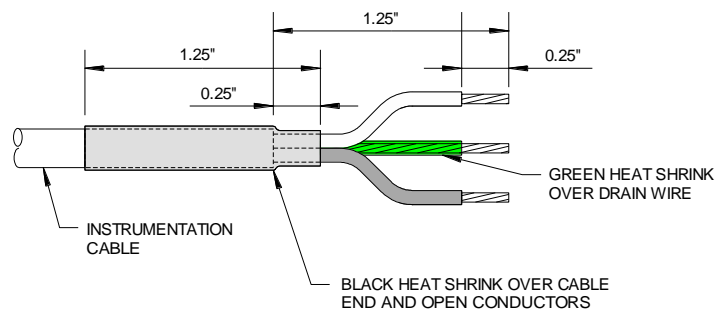
C. CONDUCTORS IN CONTROL PANELS

1. Control Panel Instrumentation (Signal) Wiring
 - a. Signal cables between analog input and output field terminals and a PLC shall be connected to the field terminals as shown in Specification 16940.
 - b. All cables shields shall be terminated at the field terminal end. Connections to the PLC analog input and output terminals shall not land the shield.

- c. Signal cable conductors and their shields/drains shall not be separated greater than as described below.
2. Control Panel Communication and Networking Wiring
- a. All communication and networking cables inside control panels shall have their ends made up with terminal connectors. No cables shall be left open-ended.
 - b. Cables shall be routed inside Panduit™ or neatly tied to other conductor bundles.

D. INSTRUMENTATION (SIGNAL) CABLES

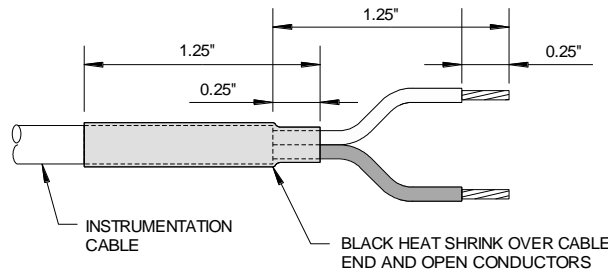
1. Preparing the Shielded End



- a. Neatly trim the end of the cable.
- b. Strip back 1.25 inch of the outer jacket taking care not to cut into the conductor insulation.
- c. Neatly trim the foil back to the edge of the outer jacket taking care not to damage the drain wire.
- d. For signal cables with a braided shield over a foil shield, carefully cut the braid back to the edge of the outer jacket.
- e. Provide a green heat shrink tube over the drain wire, leaving 0.25 inch of exposed conductor.
- f. Provide a 1.25-inch black heat shrink over the jacket, covering 0.25 inch of the exposed conductors. This properly insulates and protects the ends of the shields and the outer jacket.

- g. Strip the signal conductors exposing 0.25 inch of conductor.

2. Preparing the Unshielded End



- a. Neatly trim the end of the cable.
- b. Strip back 1.25 inch of the outer jacket taking care not to cut into the signal conductor insulation.
- c. Neatly trim the foil back to the edge of the outer jacket.
- d. Cut the drain wire at the edge of the outer jacket taking care not to damage the signal conductor insulation.
- e. For signal cables with a braided shield over a foil shield, carefully cut the braid back to the edge of the outer jacket.
- f. Provide a 1.25-inch black heat shrink over the jacket, covering 0.25 inch of the exposed conductors. This properly insulates and protects the ends of the shields and the outer jacket.
- g. Strip the signal conductors exposing 0.25 inch of conductor.

E. SPLICING CONDUCTORS

1. Install service, feeder, and motor circuits continuous without splices from equipment terminal to equipment terminal or motor lead.

Exceptions:

- *Service entry feeders at weatherheads.*

- *Branch circuits at taps for convenience receptacles and lighting.*
 - *As specifically called out.*
 - *With written permission from the Engineer.*
2. Install instrumentation and control circuits continuous without splices or terminations from source equipment terminal to destination equipment terminal.

Exceptions:

- *On terminal strips in control panels.*
 - *On terminal strips in termination panels.*
 - *As specifically called out.*
 - *With written permission from the Engineer.*
3. Where splicing is allowed, or specifically called out, install in the following manner:

- a. Splicing Inside Vaults, Handholes, Outdoor J-Boxes, or J-Boxes in Wet Areas

Power and control conductors shall be spliced per Section 2.2.A. Provide a minimum of 24 inches of length on both wires for future resplicing.

- b. Splicing Inside Motor J-Boxes

Power connections inside motor j-boxes shall be made using insulated multiple tap connectors rated for 600 Vac; N.I.S. Polaris or equal. Cover the splice with a minimum of three layers of black insulating electrical tape. Provide a single band with a minimum of two wraps of the appropriate phase color tape to the entry T-lead. Bend the connections away from the sides of the j-box and motor frame to prevent abrasion from motor vibration.

Control connections inside motor j-boxes shall be made with crimped butt-splices with heat shrink covers. The heat shrink shall overlap the butt barrel ends by a minimum of

1/2 inch on each side. Cover the splice with a minimum of three layers of black insulating electrical tape.

c. Splicing in J-Boxes and Control Panels Mounted Indoors in Dry Rooms

i. Conductors size #12 AWG through #6 AWG:

For conductors less than #6 AWG, provide crimped butt-splice with heat shrink cover. The heat shrink shall overlap the butt barrel ends by a minimum of 1/2 inch. Cover the splice with a minimum of three layers of black electrical tape. Provide a 2-wrap (minimum) single band of the appropriate phase color tape.

Exception:

- *For receptacles and lighting, reference Section 2.2.B.*

ii. Conductors size #4 AWG and larger:

(1) Terminal Connectors

For conductors larger than #6 AWG, connections shall be made using insulated multiple tap connectors rated for 600 Vac; N.S.I. Polaris or equal.

Cover the splice with a minimum of three layers of black electrical tape. Provide a 2-wrap (minimum) single band of the appropriate conductor color tape.

(2) Terminal Blocks

All power terminals shall be 600 Vac, suitable for 75 degrees C rated copper conductor.

Connect using properly sized terminal blocks.

Exception:

- *If splices are allowed by the Engineer, then use plated copper alloy compression splicing sleeves installed by high-pressure compression tools and insulated with heat shrink Raychem sleeves.*

F. REPLACING FAULTY CONDUCTORS

When replacing a faulty conductor or cable that shares a raceway with other conductors or cables, all conductors and cables must be removed and replaced with new.

Exceptions:

- *If the raceway is straight and without bends or offsets and its length is less than 30 feet, and the conductors are not bound together in the raceway, then only the faulty cable must be pulled and replaced with new. A manufacturer-approved pulling compound or lubricant must be used to minimize degradation to the remaining conductors. The contractor is responsible for the integrity of the remaining conductors.*
- *With specific approval by the Engineer.*

G. CONDUCTOR LABELLING

All conductors shall be labeled in the following manner.

Exceptions:

- *Conductors supplying power to lighting and convenience receptacles.*
- *Non-insulated ground conductors.*
- *At each motor tag for winding lead numbers. Make all phase rotation changes for motor direction changes at the motor to maintain correct color phase sequence in equipment.*
- *In each enclosure or box where more than one ungrounded power conductor is spliced or connected, tag for panelboard identification and pole number (reference Section 3.3C.).*

1. Conductors shall be labeled the same at each end in a place where the label can be clearly read without moving other wires or rotating the label.
2. Conductor labels shall reference the device (destination) tag as provided on the "TAG LIST" in the Plans. For example, conductors from panelboard [01 PB 01] to dedicated receptacle [01 DREC 05] shall be labeled as follows:

Line:	01DREC05.L
Neutral:	01DREC05.N
Ground:	01DREC05.G

3. Conductor labels shall each be unique for each circuit. For example, 10 control conductors from Main Control Panel [02 CP 01] (source) to Automatic Transfer Switch [02 ATS 01] (destination) shall be labeled as follows:

Wire #1:	02ATS01.01
Wire #2:	02ATS01.02
Wire #9:	02ATS01.09
Wire #10:	02ATS01.10

4. The labels shall be white heat shrink sized appropriately for the associated conductor with typed lettering in black indelible ink.
5. Label each conductor. When terminating cables, if there is insufficient room to provide a label on each conductor, then label the cable sheath.
6. Tag for phase rotation at each power connection.

Exception:

- *At motor connections.*

H. CONDUCTOR COLORS

1. For conductor colors inside control panels, reference Section 3.1.C.1.

2. Do not use white, gray, green, or green with yellow stripes color for any power, lighting, or control conductor not intended for neutral or equipment grounding purposes.

Exception:

- *Instrumentation and control multi-conductor cables may use white, gray, or green singly or as part of a trace color in addition to the base color.*

3. Equipment grounding conductors: Green or green with yellow stripes.

4. 480/277 volt, 3-phase systems:

Phase A	Phase B	Phase C	Neutral
Brown	Orange	Yellow	Gray

5. 208/120 or 240/120 volt, 3-phase systems:

Phase A	Phase B	Phase C	Neutral
Black	Red	Blue	White

6. 240/120 volt, single phase systems:

Phase A	Phase B	Neutral
Black	Red	White

7. Use wire with insulation of required color for conductors of #6 AWG and smaller. For wire larger than #6 AWG, where not available in specified colors, use conductor color marking tape per Section 2.3.C. When conductors are marked in this manner, mark each conductor at all accessible locations such as panelboards, junction boxes, pullboxes, auxiliary gutters, outlets, switches, and control centers.

8. Connect power conductors of the same color to the same phase throughout the installation. Viewing all equipment from the front, make connections so phase color sequence is in the same order as that for panelboards, switchboards, motor control centers, etc.

I. PULLING CONDUCTORS

1. Instrumentation, Communication, Networking, and Fiber Cables

Make all cable pulls by hand using a manufacturer-approved pulling compound or lubricant where necessary.

2. Power and Control Conductors

- a. Make all cable pulls by hand where possible. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, or wrapping extra conductor into an eye, that will not damage cables or raceway.
- b. On mechanically-assisted pulls use a manufacturer-approved pulling compound or lubricant where necessary. The compound used must not deteriorate the conductors or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Install pullboxes where necessary to prevent exceeding manufacturer's recommendations.

3. Cut cable or conductor ends off after pulling and clean all pulling compound from exposed conductors before terminating.

J. CABLE SUPPORTS

Support cables according to Section 16050.

Provide vertical conductor support per NEC Table 300.19(A).

K. WIRING AT OUTLETS

1. Install conductor at each outlet, with at least 6 inches of slack. Connect only to receptacle screw terminals using insulated spade-type lugs.
2. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer, and in compliance with other Sections of Division 16.

4.3 FIELD QUALITY CONTROL

A. TESTING

1. Provide conductor megger testing per Specification 16050, Section 3.

***** END OF SECTION *****

SECTION 16130

RACEWAY AND BOXES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 RELATED SECTIONS SPECIFIED ELSEWHERE

<u>Sections</u>	<u>Items</u>
01300	Submittals
02530	Utility Structures
16050	Basic Electrical Materials and Methods
16060	Grounding and Bonding
16120	Conductors and Cables
16140	Wiring Devices

1.3 DEFINITIONS

A. 100 PERCENT CONTINUOUS

100 percent continuous means that electrical continuity shall be maintained over a conduit's entire length and that such conduits shall consist of only RGS (whether PVC-coated or not), LFMC, or combinations of these types. There can be no break in the electrical continuity by non-metallic components.

EMT conduits are not considered 100 percent continuous.

B. CONDUIT BODIES

A separate portion of a conduit system that provides access through a removable cover to the interior of the system at a junction of two or more sections of the system.

C. CONTROL CONDUITS

Control conduits typically contain cables or conductors in the range of 12 Vdc to 120 Vac. These cables/conductors are used to provide discreet field inputs and outputs to motor drives, PLC controllers, operator stations, etc. They typically connect to discreet I/O field devices like local

panel pushbuttons, indicating lights, selector switches, field limit switches, relay circuits, etc.

D. CONTROL PANELS

Control panels are enclosures in which one or more circuits are changed, unlike junction boxes where circuits are simply routed through the panel. Control panels may be as simple as an enclosure with a pilot light or they may be very complicated with hundreds of I/O terminations. For Control Panel considerations, reference Specification 16940.

E. CONVENIENCE RECEPTACLES

Reference Section 16140, Definitions.

F. DEVICE BOXES

Device boxes are electrical boxes used for receptacles, light switches, dimmers, and other similar devices. Selector switches, indicating lights, displays, etc., are mounted in control panels and equipment enclosures, not in device boxes.

G. DRIP FITTINGS

Drip fittings are used to drain water from conduit entry points, junction boxes, or other enclosures where accumulation of moisture must be removed. They are also intended to disable the entry of foreign materials, including tools and fingers, through the drain.

H. DRY LOCATIONS

Reference Section 16050, Definitions.

I. EMT

Electrical Metallic Tubing (a type of RMC).

J. EQUIPMENT VAULT

An Equipment Vault is a VAULT that contains one or more electrical devices that are terminated within the vault; such as flow meters, control valves, control or power panels, lighting, and etc.

SEE VAULTS

K. FINISHED AREAS

Reference Section 16050, Definitions.

L. FMC

Flexible Metal Conduit (a type of RMC).

M. FRP

Fiberglass Reinforced Plastic (a type of RNC).

N. HANDHOLES

A handhole is a pullbox that is not sufficiently sized for entrance of personnel (reference PULLBOXES).

O. INSTRUMENTATION CONDUITS

Instrumentation conduits contain cables and conductors that carry low-power modulated or communication signals. They may include 4-20 mA current loops, 0–10 volt analog signals, 5 to 12 Vdc digital (TLL) data, analog or digital communications signals, etc. They may also include low-voltage compliance power to instruments such as 5 Vdc, ± 15 Vdc, or 24 Vdc.

P. JUNCTION BOXES

Junction boxes are electrical enclosures used for combining, splitting, pulling, or redirecting electrical circuits. Junction boxes may terminate one conduit or join multiple conduits. Circuits are not *altered* inside a junction box. Enclosures where circuits are altered are called CONTROL PANELS. With the exception of terminal strips, junction boxes do not contain electrical devices.

1. Junction Boxes, Type J1

Junction boxes identified as TYPE J1 can contain only non-linear power circuits.

2. Junction Boxes, Type J2

Junction boxes identified as TYPE J2 can contain only intrinsically safe circuits.

3. Junction Boxes, Type J3

Junction boxes identified as TYPE J3 can contain only instrumentation circuits that are not intrinsically safe.

Junction boxes not containing circuits of the types identified for TYPE J1, TYPE J2, or TYPE J3 are simply called “junction boxes” (without a TYPE identifier).

Q. LFMC

Liquidtight Flexible Metal Conduit (a type of RMC).

R. LINEAR POWER LOADS

Linear power loads are those that are not VFD circuits (both line or load), and are not UV ballast circuits. Although actually non-linear, fluorescent lighting circuits shall be considered linear power loads.

S. NON-LINEAR POWER LOADS

Non-linear power loads shall include all VFD circuits (both line or load) and all UV ballast circuits. Although actually non-linear, fluorescent lighting circuits shall be considered linear.

T. POWER CONDUITS

Power conduits contain branch and feeder conductors with voltages 120 Vac and above. These conductors provide operating power to MCCs, panels, motors, lighting, receptacles, HVAC, etc. Conductors can be of #12 AWG wire gauge and larger, either separate or in power cables.

U. PROCESS AREAS

Reference Section 16050, Definitions.

V. PULLBOXES

Pullboxes are underground electrical enclosures, sufficiently sized to allow the entrance of personnel, used for combining, splitting, pulling, or redirecting electrical circuits. Pullboxes may terminate one conduit or join multiple conduits. A pullbox can be considered an underground junction box.

Circuits are not altered or terminated inside a pullbox. Pullboxes do not contain electrical equipment or devices.

Exception:

- *Pull boxes may include a sump pump.*

Handholes are types of pull boxes but are not sufficiently sized to allow the entrance of personnel (reference HANDHOLES).

W. PVC

Polyvinyl Chloride Conduit (a type of RNC).

X. PVC-RGS

Polyvinyl chloride, externally coated RGS (a type of RMC).

Alias: May be called or shown on Plans and elsewhere in specifications as PVC-Coated RGS or PVC-RMC.

Y. PVC-RMC

Reference PVC-RGS.

Z. RGS

Rigid Galvanized Steel (a type of RMC).

AA. RMC

Rigid Metal Conduit (General NEC Category).

BB. RNC

Rigid Nonmetallic Conduit (General NEC Category).

CC. SURFACE RACEWAYS

A metallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.

DD. VAULTS

A vault is an underground structure, serviceable or accessible only from the top. Handholes, Equipment Vaults, and Pullboxes are considered vaults.

EE. WET LOCATIONS

Reference Section 16050, Definitions.

FF. WIREWAYS

Sheet metal troughs with hinged or removable covers for housing and protecting electric wires and cable in which conductors are laid in place after the wireway has been installed as a complete system.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Provide data for surface raceways, wireways and fittings, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

See Section 16050.

1.6 COORDINATION

Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

Coordinate electrical work with outside utilities associated with the project.

Non electrical piping and structural has priority over underground conduit routing.

Exception:

- *Unless specifically coordinated otherwise with the General Contractor.*

PART 2 PRODUCTS

2.1 METALLIC CONDUIT TYPES

A. EMT

1. Conduit

Galvanized steel tubing meeting ANSI C80.3.

2. Conduit bodies shall be galvanized, or epoxy coated cast iron or aluminum one piece with galvanized, or epoxy coated cast cover, gasket, and threaded hubs. Use stainless steel screws or other approved non-corroding screws to hold cover in place.

3. EMT connectors shall be compression type only. Set screw connectors shall not be allowed.

4. Conduit clamps for EMT shall be stamped galvanized steel.

B. FMC

1. Conduit

Flexible, galvanized steel convolutions forming a continuous raceway.

2. Connectors

Galvanized steel, screw in, approved for grounding.

C. LFMC

1. Conduit

Flexible, galvanized steel convolutions forming a continuous raceway, covered by a liquid tight PVC layer. Electri-Flex Type LA or American Sealtite, Type UA

2. Connectors

Galvanized steel, screw in, grounding type with a ferrule, which covers the end of the inside and outside of the conduit.

D. RGS

1. Conduit

Hot dipped galvanized with threaded ends meeting ANSI C80.1.

2. Couplings

Steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. No indent or set screw type.

a. Couplings

Unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.

b. Nipples

Factory made through 8 inches, no running threads.

c. Conduit bodies shall be galvanized, or epoxy coated cast iron or aluminum one piece with galvanized, or epoxy coated cast cover, gasket, and threaded hubs. Use stainless steel screws or other approved non-corroding screws to hold cover in place.

3. Conduit Clamps

Conduit clamps for RGS shall be cast iron.

E. PVC-COATED RGS, PVC-RMC

1. General

a. A proprietary colored urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.

b. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30 degrees F (-1 degrees C).

- c. All male and female threads on conduit, elbows, and nipples shall be protected by application of an electronically conducting corrosion resistant compound.
- d. Installation of the PVC coated conduit system shall be performed in accordance with the manufacturer's installation manual.
- e. Conduits and fittings shall meet the following standards:
 - i. ASTM D870
 - ii. ASTM D1151
 - iii. ASTM D3359
 - iv. ASTM D1308
 - v. NEMA RN1

2. Conduit

- a. The PVC coated rigid metal conduit must be UL listed. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be UL listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed. All conduit and fittings must be new, unused material. Applicable UL standards may include: UL 6 Standard for Safety, Rigid Metal Conduit, UL 514B Standard for Safety, Fittings for Conduit and Outlet Boxes.
- b. The conduit shall be hot dip galvanized inside and out with hot dipped galvanized threads.

3. Fittings and Accessories

The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inches of mercury (vacuum for 72 hours shall be available).

- a. A PVC sleeve extending one pipe diameter or 2 inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.
 - b. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
 - c. Conduit Form 8 Bodies shall be 1/2 inch through 2-inch diameter, shall have a tongue-in-groove “V-Seal” gasket to effectively seal against the elements. Conduit bodies shall be Form 8 and shall be supplied with plastic encapsulated stainless steel cover screws.
 - d. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts will be supplied with plastic encapsulated nuts that cover the exposed portions of the threads.
 - e. Conduit clamps and fittings for PVC-Coated RGS conduits shall be 316L stainless steel.
4. Approved Material
- a. Plasti-Bond REDH2OT, Perma-Cote, or KorKap manufactured by Robroy Industries.
 - b. Ocal-Blue Steel conduit and fittings as manufactured by Ocal, Inc.
 - c. Any deviation from the above approved materials must be approved by the Engineer.

2.2 NONMETALLIC CONDUIT TYPES

A. PVC

1. Conduits

NEMA TC 2, Schedule 40 or 80 PVC.

2. Fittings and Accessories

NEMA TC 3; match to conduit type and material, but elbows shall be RMC.

3. Conduit bodies

Where allowed, shall match type, material, and gauge of conduit.

B. FIBERGLASS/REINFORCED THERMOSETTING RESIN (RTR)
ELBOWS

1. General

- a. Listed by UL to the UL 2420 Below Ground standard. The resin system shall be epoxy based, with no fillers. The fiberglass shall consist of continuous E-glass Grade "A" roving.
- b. Carbon black shall be used as ultra violet inhibitor to protect the elbows and fittings during storage and exposure to the outdoors. Elbows shall be black in color.
- c. The internal elbow walls shall be smooth with all fibers embedded in the epoxy.
- d. All shall meet the nominal radius of + or - 2°. The wall thickness shall meet the tolerances as shown in NEMA TC 14.
- e. Elbows shall meet the following standards
 - i. Volume and Surface Resistivity: ASTM D257
 - ii. Dielectric Constant and Dissipation Factor: ASTM D150
 - iii. Dielectric Strength: ASTM D149
 - iv. Tensile Strength, Axial: ASTM D2105
 - v. Compressive Strength: ASTM D695
 - vi. Modulus of Elasticity and Thermal Conductivity: ASTM D2105

vii.	Thermal Conductivity:	ASTM D5930-1
viii.	Specific Gravity:	ASTM D792
ix.	Glass Content:	API 15LR
x.	Water Absorption:	ASTM D570
xi.	Barcol Hardness:	ASTM D2583
xii.	Coefficient of Thermal Expansion:	ASTM D696
xiii.	Impact Resistance:	ASTM D2444
xiv.	Stiffness at 5 Percent Deflection:	ASTM D2412

2.3 OUTLET AND DEVICE BOXES

A. STANDARD METAL BOXES

Assembled from stamped steel hot dipped zinc galvanized coated flat pieces, welded or mechanical assembled into a device box, with knockouts for conduit or connector entrance, meeting NEMA OS 1, with plaster or extension rings and necessary mounting appurtenances to suite construction and application.

B. CAST BOXES

1. Cast Aluminum

Epoxy coated cast aluminum box, one piece, with mounting lugs, with threaded holes or hubs, with internal green ground screw and with neoprene gaskets.

2. Cast Iron

Cast iron with electro-galvanized and aluminum acrylic paint finish, one piece, with mounting lugs, with threaded holes or hubs, with internal green ground screw and with neoprene gaskets.

C. DEVICE COVERS

1. Plastic: Thermoplastic nylon, device-mount, ivory.

2. Aluminum: Sheet Aluminum.
3. Cast Iron: Iron alloy.

D. SWITCH ACTUATORS

1. Aluminum: Lever-arm type, raintight, cast aluminum matching the metallurgy of the device box.
2. Cast Iron: Lever-arm type, raintight, cast iron alloy matching the metallurgy of the device box.

E. WEATHERPROOF COVERS AND PLATES

Weather proof, self-closing, die-cast aluminum, UL listed.

F. IN-SERVICE COVERS

Shall be weather proof and hinged from top with removable cord slots.

2.4 JUNCTION BOXES, HANDHOLES, AND VAULTS

A. JUNCTION BOXES

1. Standard

Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1. Boxes 6" x 6" x 4" or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication.

2. Cast

Cast iron with electrogalvanized and aluminum acrylic paint finish, one piece, with threaded cover of the same metallurgy and finish, with mounting lugs, with threaded holes or hubs, with internal green ground screw and with neoprene gaskets; explosion-proof, dust-ignition-proof, raintight, rated for Class I, Division 1 and 2, Groups C, D.

3. Stainless Steel

NEMA 4X 316L stainless steel with gasketed screw down cover.

4. Explosion Proof for Internal Wire Termination

Explosion proof junction boxes shall be 18"H x 12"W x 6"D (minimum inside dimension) cast aluminum; explosion-proof, dust-ignition-proof, raintight, rated for Class I, Division 1 and 2, Groups C, D; Killark #EXB-12186-N34 or equal.

Exception:

- *Unless specifically stated otherwise on the Plans.*

5. Explosion Proof, No Terminations

Cast iron with electrogalvanized and aluminum acrylic paint finish, one piece, with threaded cover of the same metallurgy and finish, with mounting lugs, with threaded holes or hubs, with internal green ground screw and with neoprene gaskets; explosion-proof, dust-ignition-proof, raintight, rated for Class I, Division 1 and 2, Groups C, D.

Exception:

- *Unless specifically stated otherwise on the Plans.*

B. HANDHOLES

1. Material and Strength

Handholes shall be made from Concrete or Polymer Concrete. The boxes and covers are required to conform to all test provisions of ANSI/SCTE 77 2002 "Specification for Underground Enclosure Integrity" for Tier 15 applications (Design Load Vertical 22,500 lbs. and Lateral 800 lbs/sq. ft.) and to be Listed and Labeled. The boxes must physically accommodate and structurally support compatible covers, which possess the Tier rating. In no assembly can the cover design load exceed the design load of the box. All components in an assembly (box and cover) are to be manufactured by the same manufacturer. All covers are required to have a minimum coefficient of friction of 0.50 in accordance with ASTM C1028. Independent third-party verification or test reports stamped by a registered Professional Engineer certifying that all test provisions of this specification have been met are required with each submittal. The cover is to have an identifying function descriptor imprinted on it. The Descriptor shall be

ELECTRICAL, CONTROL, SIGNAL, TELEPHONE, STREET LIGHT, or similar approved by the Engineer.

Handholes with metallic lids shall be grounded per Specification Section 16060.

Handhole lid assemblies comprised of steel shall have a factory-applied galvanized finish.

Exception:

- *Unless the assembly is fabricated from stainless steel.*

2. Manufacturers

Quazite (Strongwell Corp.)
Carson Industries

C. PULLBOXES AND VAULTS

Precast concrete structures with preformed knockout holes for conduit entrance. Reference Section 02530, Utility Structures.

Pullboxes and vaults with metallic lids shall be grounded per Specification Section 16060.

Pullbox lid assemblies comprised of steel shall have a factory-applied galvanized finish.

Exception:

- *Unless the assembly is fabricated from stainless steel.*

PART 3 APPLICATION

3.1 CONDUIT BODIES

This section describes the types of raceways, junction boxes, and device boxes that can be used for different circuits and different environments. Reference Section 4.1 for methods and practices required for installation.

A. CABLE AND CONDUIT SCHEDULE

The Cable and Conduit Schedule shall be considered absolute. No changes to wire sizes, wire count, insulation type, circuit type, or conduit size shall be allowed without approval from the engineer.

The Cable and Conduit Schedule does not indicate conduit type (PVC, EMT, RGS, etc.) since, in many cases, a conduit's type may change between its source and destination. The rules stated in this specification define the necessary and allowed conduit type(s) for various applications and routes.

B. RACEWAY REQUIREMENTS

The term "RGS conduits" refers to a type of conduit body and does not imply whether the conduit is PVC-coated or not. Certain applications require RGS conduits with PVC coating, others do not. Reference Section 3.2, "RGS RACEWAY PROTECTIVE COATINGS" for these requirements.

1. Circuit Types and Categories

a. Circuit Types

Conduits are broken into three general circuit types; 1) Power, 2) Control, and 3) Instrumentation (see Definitions).

On the Cable and Conduit Schedule, Power conduits are those starting with the letter "P," Control conduits are those starting with the letter "C," and Instrumentation conduits are those starting with the letter "S."

b. Circuit Categories

Power circuits are broken into two categories, those that contain linear loads and those that contain non-linear loads (see Definitions).

Control and Instrumentation circuits are broken into two categories, those that contain intrinsically safe circuits and those that do not (see Definitions).

These types and categories are listed below in Table 3.1.B.1 below.

c. Relationships Between Circuit Categories and Conduit Types

Many electrical circuit types do not require special conduit routing considerations. However, Table 3.1.B.1 shows the circuit types where the conduit route must be 100 PERCENT CONTINUOUS (reference Definitions).

Table 3.1.B.1

Circuit		
Type	Category	100% Continuous?
Power	Linear	No
Power	Non-linear	Yes
Control	Non-intrinsic	No
Control	Intrinsic	Yes
Instrumentation	Non-intrinsic	Yes
Instrumentation	Intrinsic	Yes

2. Conduit Shape

Wiring shall be routed in pipe or tubular conduits, NOT in fabricated wireways or gutters.

Exception:

- *Unless specifically called out otherwise in the Plans.*

C. PVC SCHEDULE 40 RACEWAY APPLICATIONS

1. All straight portions of conduits completely concealed in walls, attics, concrete, or below ground (not exposed) shall be PVC Schedule 40.

Exceptions:

- *Power conduits containing non-linear loads shall be 100 percent continuous over their entire length.*
- *Control conduits containing intrinsically safe circuits shall be 100 percent continuous over their entire length.*

- *All Instrumentation conduits shall be 100 percent continuous over their entire length.*
 - *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*
 - *PVC conduit areas under roads or heavy traffic areas shall be Schedule 80.*
 - *Where specifically called out otherwise in the Cable and Conduit Schedule.*
2. All portions of power and control conduits completely concealed inside a reservoir shall be PVC Schedule 40.

D. PVC SCHEDULE 80 RACEWAY APPLICATIONS

1. All portions of conduits which contain grounding electrode conductors shall be PVC Schedule 80 and shall contain no metal fittings, connectors, or devices. Such conduits containing grounding electrode conductors shall contain no other types of conductors.
2. PVC conduit areas under roads or heavy traffic areas.
3. As stated in the Cable and Conduit Schedule.

E. RGS RACEWAY APPLICATIONS

1. All conduits requiring 100 percent continuity per Section 3.1.B.1 shall be RGS over their entire length. For coating requirements, reference Section 3.2.

Exception:

- *LFMC conduit shall be allowed per the “LFMC Raceway Applications” section herein.*
2. Underground factory or bent elbows and offsets greater than or equal to 30 degrees shall be RGS.

Exceptions:

- *Where the radius of a conduit bend is greater than or equal to 15 feet per inch of trade size.*

- *Raceways used for the containment and protection of bare grounding electrode conductors shall be PVC Schedule 80. Reference PVC Schedule 80 raceway applications.*
3. All portions of conduits exposed outdoors shall be RGS.

Exception:

- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*
4. All portions of conduits under covered structures open on any side shall be RGS.

Exception:

- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*
 - *LFMC conduit shall be allowed per the “LFMC Raceway Applications” section herein.*
5. All portions of conduits exposed on the inside of below-ground pullboxes, equipment vaults, wet wells, and dry wells (vaults) shall be RGS.

Exceptions:

- *All conduits immediately terminating after penetrating a vault wall, that are allowed to be PVC Schedule 40 underground, shall terminate as a PVC conduit bell-end.*

If the conduit is connected inside the vault to any device, conduit body, junction box, control panel, or any other conduit, then all portions of the conduit inside the vault, through the wall penetration, and 24 inches outside the vault shall be RGS and shall be grounded.

- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*

6. All portions of conduits penetrating concrete floors, walls, or ceilings shall be RGS.

Exception:

- *In below ground vaults as described above.*

7. All conduit penetrations from grade shall be RGS.

Exception:

- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*

8. All portions of exposed conduits inside closed buildings shall be RGS.

Exceptions:

- *EMT conduit shall be allowed per the “EMT Raceway Applications” section herein.*
- *LFMC conduit shall be allowed per the “LFMC Raceway Applications” section herein.*
- *All conduits containing grounding electrode conductors shall be PVC Schedule 80 over their entire length.*
- *Unless otherwise specifically called out on a separate plan or detail.*

F. LFMC RACEWAY APPLICATIONS (REFERENCE DEFINITIONS)

1. LFMC conduit shall be used for the last 18 inches of connection to motors, transformers and other vibrating equipment.
2. LFMC conduit shall be used for the last 18 inches of connection to field instruments such as flow meters in vaults and ultrasonic level transducers.
3. LFMC conduit shall be used for the last 18 inches of connection to any device that may require minor movement during maintenance or repair or that may require physical adjustment.

4. LFMC conduit shall be used for connections between fixed rigid conduits at the swivel point of headworks screens and other similar types of applications per Figure 3.1.F.3. Provide a complete loop of LFMC conduit of sufficient length to allow complete and unencumbered motion of equipment.

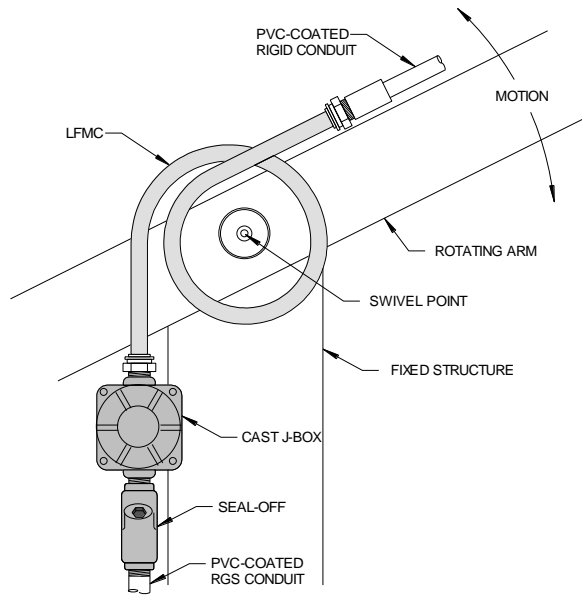


Figure 3.1.F.3

Example of LFMC Application at a Swivel Point

5. LFMC conduit may be used in pull vaults for connections between conduit penetrations and junction boxes inside the vault where space is limited.

G. EMT RACEWAY APPLICATIONS (REFERENCE DEFINITIONS)

1. Exposed conduits may be EMT in completely enclosed dry (see Definitions) rooms.
2. EMT conduits may be used in attics and where concealed in walls.

Exception to the use of EMT:

- *Where conduit is required to 100 percent continuous.*

H. FIBERGLASS/RTR ELBOW APPLICATIONS

1. Fiberglass conduit shall not be used.

2. Fiberglass elbows may be used in underground applications with or without concrete encasement.

Exception to the use of fiberglass elbows:

- *Where raceway is required to 100 percent continuous.*

3.2 RGS RACEWAY PROTECTIVE COATINGS

Protected RGS conduits are used to minimize conduit degradation from moisture and chemicals.

Where called in the Plans or Specifications as “Protected RGS,” “PVC-Coated RGS,” “PVC-Coated,” “PVC-RGS,” or “PVC-RMC,” all such conduits, elbows, and fittings shall be factory coated PVC as defined in Section 2.1.

A. PVC-COATED RGS CONDUIT APPLICATIONS

1. All portions of RGS elbows, bends, straight pipes, couplings, and fittings buried underground shall be PVC-Coated.
2. All portions of RGS elbows, bends, straight pipes, couplings, and fittings encased in concrete shall be PVC-Coated.
3. All portions of RGS elbows, bends, straight pipes, couplings, and fittings exposed outdoors shall be PVC-Coated.
4. All portions of RGS elbows, bends, straight pipes, couplings, and fittings inside underground vaults, pullboxes, wet wells, and dry wells shall be PVC-Coated.
5. All portions of RGS elbows, bends, straight pipes, couplings, and fittings exposed in Chemical Rooms (reference Definitions) shall be PVC-Coated.
6. All portions of RGS conduits penetrating concrete floors and below-ground walls and ceilings shall be PVC-Coated at least 12 inches into the exposed area and extending at least 24-inches underground.

Exceptions:

- *Where specifically noted to be otherwise in the Plans.*

- *Non-metallic conduits that terminate at the wall of a pullbox.*

3.3 JUNCTION AND DEVICE BOX APPLICATIONS

A. JUNCTION BOXES

1. Junction boxes for Instrumentation, Intrinsically Safe, and Non-Linear Power circuits (see Definitions) shall be hinged steel, 6" x 6" x 4" minimum.
2. Dry Areas (see Definitions).
 - a. Flush-mounted junction boxes may be the standard type.
 - b. Wall-mounted junction boxes shall be the NEMA 1 gasketed.
3. Wet Areas (see Definitions).
 - a. NEMA 4X 316L stainless steel.

Exceptions:

- *Except in pullboxes, cast junction boxes shall be allowed for applications where three conduits or less approach from three different directions and no terminations are made inside the junction box.*
 - *Unless called out otherwise on the Plans*
4. Hazardous Areas (see Definitions).
 - a. Junction boxes shall be explosion-proof, dust and ignition-proof, raintight, rated for Class I, Division 1 & 2, Group C, d environments and shall conform to NEC Articles 500 through 517 (reference Section 2.5.A).

B. DEVICE BOXES, ACTUATORS, AND COVERS

All exposed boxes shall be of cast construction.

All aluminum and cast iron covers shall be provided with a weatherproof gasket.

1. Outdoors, In Pullboxes, In Equipment Vaults

a. Receptacles

Cast iron device box body with cast aluminum gasketed cover and top-opening “in-service” cover.

Exception:

- *Cast aluminum device box bodies may be used if specifically called out on the Plans or approved by the Engineer.*

b. Light Switches

Cast iron device box body with cast iron gasketed cover and lever-arm actuator.

Exception:

- *Cast aluminum device box bodies with gasketed die cast aluminum covers and lever arm actuators may be used if specifically called out on the Plans or approved by the Engineer.*

2. Indoor, Wet Areas (see Definitions).

Flush-mounted (recessed) junction boxes may be the standard metal type.

These boxes will usually be mounted in wood or steel stud framed walls with gypsum plasterboard or similar surfacing cover. Boxes mounted in Concrete Masonry Unit (Block) walls shall be Masonry type boxes.

a. Receptacles

- i. Recessed (flush-mount) – standard device box body with gasketed die cast aluminum, snap-action, weatherproof cover.
- ii. Surface-mounted – cast aluminum device box body with gasketed die cast aluminum, snap-action, weatherproof cover.

- b. Light Switches
 - i. Recessed (flush-mount) – standard device box body with gasketed cast aluminum switch cover.
 - ii. Surface-mounted – die cast aluminum device box body with gasketed cast aluminum switch cover.
- 3. Indoor, Dry Areas (See Definitions)
 - a. Receptacles
 - i. Recessed (flush-mount) – standard device box body with plastic cover.
 - ii. Surface-mounted – cast aluminum device box body with plastic cover.
 - b. Light Switches
 - i. Recessed (flush-mount) – standard device box body with plastic switch cover.
 - ii. Surface-mounted – cast aluminum device box body with plastic switch cover.
- 4. Hazardous Areas (see Definitions).
 - a. Explosion proof.

3.4 PULLBOX AND HANDHOLE APPLICATIONS

A. PULLBOXES

Pullboxes shall be provided as shown on the Plans and as required by the Utility Companies.

- 1. Pullboxes shall be 6' x 6' x 4' deep minimum.

Exceptions:

- *Pullboxes with less than 2 TYPE J1, TYPE J2, or TYPE J3 junction boxes (reference Definitions) shall be allowed to be 4' x 4' x 4' minimum.*

- *Unless specifically called out otherwise on the Plans.*
 - *Unless called out otherwise by a Utility Company.*
2. Pullboxes shall be provided with metal H30 hatch lids.

Exceptions:

- *If pullboxes are located where only light load vehicular traffic is present, then the hatch lids shall be rated at H25.*
 - *If pullboxes are located where no vehicular load traffic is present, then the hatch lids shall be rated at H20.*
3. Pullbox lids shall be cast, engraved, or otherwise permanently marked with the legend “ELECTRICAL.”

B. HANDHOLES

Handholes are used as pull and splice points in underground installations and are typically installed in driveways, parking lots, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic.

1. Handholes shall be set adjacent to each pole light pedestal.

Exception:

- *Unless specifically shown or called out otherwise on the Plans.*

PART 4 EXECUTION

4.1 EXAMINATION

Examine surfaces and spaces to receive raceways, boxes, for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

4.2 INSTALLATION, GENERAL

A. COORDINATION WITH OTHER WORK

Wherever practical, route conduit with adjacent ductwork or piping.

1. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes or other heat sources operating at temperatures above 100 degrees F.
2. When installing utility conduits, comply with the spacing and depth requirements of the utilities.
3. Non-electrical buried piping has routing priority over electrical burials.

B. MOUNTING PRACTICES

1. All conduits in process areas shall be surface mounted unless specifically called out otherwise on the Plans.
2. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
3. Where several conduits follow a common route, stagger pull boxes, junction boxes, pulling sleeves, and fittings.

C. DEVICE BOX INSTALLATION

1. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.
2. Recess boxes in the wall, floor, and ceiling surfaces in finished areas. Set boxes plumb, level, square and flush with finished building surfaces within 1/16 of an inch for each condition. Set boxes so that box openings in building surfaces are within 1/8 of an inch of edge of material cut-out and fill tight to box with building materials. Back boxes with structural material to prevent rotation on studs or joists. Use gang boxes wherever more than one device is used at one location.
3. Surface mount boxes to building structures with a minimum of 1/4-inch spacing and with a minimum of two fasteners. Provide attachments to withstand an additional force of 100 pounds applied vertically or horizontally.

4. Set recessed boxes at the following heights to the bottom of the box, except where noted otherwise in the Plan Set:
 - a. Convenience outlet receptacles in finished areas at 18 inches above floor.
 - b. Lighting switches, dimmers, etc., at 42 inches above floor.
 - c. Wall mounted telephones at 60 inches above floor.
 - d. Boxes for outlets on cabinets, countertops, shelves, and above countertops at 2 inches above the finished surface or 2 inches above the back splash. Verify size, style, and location with the supplier or installer of these items before installation.
5. Set surface-mounted receptacle and lighting boxes in wet areas 42 inches above the finished floor to the center of the box, unless called out otherwise in the Plan Set.
6. Set surface-mounted boxes for lighting switches within 12 inches of the door opening on the strike or lock side of the door or on the side closing last unless indicated otherwise in the Plan Set.
7. Arrange boxes used in wet areas to drain moisture away from devices or enclosures for equipment and make conduit connections from below.
8. Set floor boxes level and adjust to finished floor surface.

D. CONDUIT INSTALLATION

Install conduit as a complete and continuous system without wires. Mechanically secure to boxes, fittings, and equipment. Electrically connect conduits to all metal boxes, fittings, and equipment.

1. All field or manufactured ferrous metal threaded connections of conduits and fittings shall be installed with a coating of electrically conductive, corrosion resistant, copper colloidal compound such as “Shamrock Kopr-Shield™ Compound” or equivalent.
2. Keep conduits clean and dry. Close each exposed end.

3. Properly ground each metallic box, cover, lid, hatch, conduit, etc., in compliance with the National Electrical Code and Specification Section 16060.
4. When blowing through conduits, cover electrical components installed in enclosures to avoid blowing dirt, shavings, or moisture into equipment.
5. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel, monofilament plastic line, or woven polyester pull line with not less than 200-lb tensile strength. Leave at least 8 inches of slack at each end of the pull wire.
6. Install exposed raceways in lines parallel or perpendicular to the building or structural member's lines except if structure is not level then follow the surface contours as much as practical. Do not crossover or use offsets if they can be avoided by installing the raceway in a different routing.
7. Run parallel or banked conduits together, on common supports where practical.
8. Make bends in parallel or banked runs concentric (common radius point, expanding radius). Use factory elbows only where elbows can be installed concentrically; otherwise, provide field bends for parallel raceways.
9. Select surface raceway outlet boxes to which lighting fixtures are attached of sufficient diameter to provide a seat for the fixture canopy.
10. Provide surface metal raceway outlet box and the backplate and canopy at the feed-in location of each end-stem suspension fluorescent lighting fixture.
11. Labeling

With the exception of conduits supplying power to lighting and convenience receptacles, all conduits shall be labeled in the following manner.

- a. Conduits shall be labeled at each entrance and exit of a raceway, box, and device. Labels shall be placed no more than 3 inches from the relevant entrance or exit and shall be

positioned in a manner where they can best be read by technicians and maintenance personnel.

Exception:

- *Only one label shall be required for conduits less than 6 feet in length where the entire conduit can be seen from a single point.*
- b. The labels used shall be permanent items manufactured specifically for tagging conduits in direct sunlight and wet environments.
 - c. The conduit label shall be the full conduit number as listed on the Cable and Conduit Schedule.
 - d. The conduit label shall be attached near the ends of conduit stub ups through floors and penetrations into vaults even if equipment is set over the conduit.

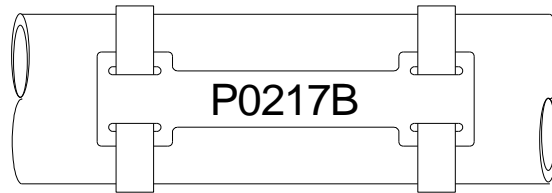


Figure 4.2.D.11

Example of a Conduit Label

E. RACEWAY TERMINATIONS AND CONNECTIONS

1. Join raceways with fittings designed and approved for the purpose and make joints tight.
2. Make connections waterproof and rustproof by application of a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.
3. PVC–RMC Conduits

Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

4. Apply PVC adhesive by brush.

5. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
6. Cut ends of conduit square with hand or power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Make conduit threads cut in the field with the same effective length and same thread dimensions and taper as specified for factory-cut threads.

7. Flexible Connections

Use maximum of 18 inches of flexible conduit for equipment subject to vibration, noise transmission, removal, or movement; and for all motors. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to fixed equipment. Recessed and semi-recessed lighting fixtures may use up to 6 feet of flexible conduit, or 11 feet of premanufactured lighting “whips.” Use LFMC in wet or damp locations. Do not strap flexible conduit to structures or other equipment.

8. Provide double locknuts and insulating bushings at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished part against the box. Use grounding type bushings where connecting to concentric or eccentric knockouts.

Exception:

- *In wet areas, conduit entries that are made into the side or top of an enclosure shall be made using Myers hubs.*

9. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
10. Support conduit connections to motors or other equipment independently of the motor or equipment. Raise or drop vertically to the nearest practicable point of connection to the unit. Run vertical drops to the floor and fasten with a floor flange. Unsupported drops are not permitted. Horizontal runs on the floor or on equipment are not permitted. Drop or raise at the appropriate closest location. Run conduit on equipment frames or supports to

closely follow the contours of the equipment. Locate conduit to maintain access to all equipment services and adjustment points and so as not to interfere with operation of the equipment.

11. Connect conduit to hubless enclosures, cabinets, and boxes with double locknuts and with insulating type bushings. Use grounding type bushings where connecting to concentric or eccentric knockouts. Make conduit connections to enclosures at the closest point possible where the devices are located to which the circuits contained in the conduit will connect.

Exception:

- *In wet areas, connect to enclosures, boxes, and devices from the bottom side. In rare cases where bottom entry is not possible, side and top entries shall be made using Myer-type hubs.*

F. EXPANSION FITTINGS

Where conduits cross building expansion joints, use suitable sliding or offsetting expansion fittings. Unless specifically approved for bonding, use a suitable bonding jumper.

Exception:

- *For 100 percent continuous conduits, provide an LFMC loop to compensate for expansion. Include conduit outlet boxes for maximum bend compliance.*

G. RACEWAY SUPPORT

Support raceways as specified in Section 16050.

1. Provide anchors, hangers, supports, clamps, etc., to support the raceways from the structures in or on which they are installed. Do not space supports further apart than 10 feet.
2. Provide sufficient clearance to allow conduit to be added to racks, hangers, etc., in the future.
3. Support raceway within 3 feet of every outlet box, junction box, panel, fitting, etc.

4. Support raceway and boxes in an approved manner by:
 - a. Expansion shields in concrete or solid masonry;
 - b. Toggle bolts on hollow masonry units;
 - c. Wood screws on wood;
 - d. Metal screws on metal.
5. Raceway in wet areas shall have clamp backs or other appropriate spacers to hold them a minimum of 1/2 inch off the surface. Horizontal runs on the roof surface shall be blocked at every 5 feet to hold them a minimum of 2 inches above roof surface.

H. INSTALLING PVC-COATED RGS CONDUITS

1. Follow the manufacturer's requirements and recommendations when installing PVC-Coated RGS conduits.
2. Seal the connections to protect the conduit.
3. Provide manufacturer's PVC repair compound where the thickness of the conduit coating has been reduced or damaged (from bending, threading, nicking, etc.)

I. BENDS AND OFFSETS

1. Fabricated bends and offsets shall be made with manufacturer-approved bending tools, by manufacturer-certified personnel.
2. Where possible, use standard elbows, conduit fittings, or junction boxes to avoid fabricated bends.
3. Make bends and offsets uniform and symmetrical. Make bends and offsets so that the inner diameter is not reduced. Use expanding plugs for bends in PVC conduit of 2-inch trade size or larger. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

J. PENETRATIONS FOR RACEWAYS

1. Do not bore holes in floor and ceiling joists outside center third of member depth or within 2 feet of bearing points. Holes shall be 1-inch diameter maximum.

Exception:

- *Unless specifically approved by Structural Engineer.*
2. Penetrate through roofs with core drill hole 1/2 to 1 inch larger than conduit, flash with neoprene, caulk conduit in place and seal with silicone sealant under flashing. Sleeve roof opening where non-concrete roof construction occurs.

K. CONDUIT SEAL OFFS

Install raceway seal-off fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations as per NEC Article 500 and fill them with UL-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 seal-off fittings in compliance to NFPA 70 and NFPA 820.

Exceptions:

Seal-off fittings filled with removable compound may be used in non-hazardous applications as listed below to eliminate the possibility of the passage of water or water vapor.

- *Where conduits pass from warm to cold locations.*
- *Where conduits enter or exit buildings below grade.*
- *Where specifically called out on the Plans.*

4.3 PULLBOXES

A. PULLBOX STRUCTURAL INSTALLATION

Strict compliance must be followed regarding the installation of conduits, conductors, junction boxes, and grounding inside pullboxes.

1. Install pullboxes outside of classified areas. Field verify measurements to assure compliance.

Exception:

- *Unless specifically called out otherwise in the Plans.*

B. PULLBOX CONDUIT, CONDUCTOR, JUNCTION BOX, AND GROUNDING INSTALLATION

The six types/categories of electrical circuits as defined in Section 3.1.B.1 shall be installed as described herein (reference Figure 4.3.B).

1. Installing circuits in conduits NOT Identified As 100 percent Continuous in Pullboxes
 - a. Conduits NOT identified as 100 percent continuous shall terminate at the penetration into the pullbox with a PVC Schedule 40 bell-end.
 - b. Cables and conductors shall be open-wire within the pullbox.
 - c. Coil 2 wraps at 24 inches per wrap of each open wire. Bind the wraps with Ty-Rap® cable fasteners.
 - d. Support open wires a minimum of 18 inches above the pullbox floor on 316L stainless supports mounted near the edges of the pullbox, leaving room in the center for safe entry, work, and exit. Secure wires with Ty-Rap® cable fasteners.
 - e. Physically separate power and control circuits as much as possible.
 - f. Plug the ends of all open conduits with a removable filler to minimize water entry into and out of the pullbox. Repair plugging after the movement of open wiring.

- g. Seal around all conduit penetrations with non-shrink grout.
2. Installing Conduits Identified As 100 Percent Continuous in Pullboxes
- a. All conduits identified as 100 percent continuous passing through, or terminating in, a pullbox shall terminate in a TYPE J1, TYPE J2, or TYPE J3 junction box for pulling purposes, termination, and rerouting.
 - b. Provide separate junction boxes for the types of circuits listed below. Under no circumstance shall these circuit types be combined in a common junction box.
 - i. Non-linear power circuits (TYPE J1).
 - ii. Intrinsically safe circuits (TYPE J2). Note: intrinsically safe instrumentation and control circuits may be combined in TYPE J2 junction boxes.
 - iii. Instrumentation circuits, not intrinsically safe (TYPE J3).
 - c. All conduit entries into junction boxes shall be watertight. Conduit entries made into the side or top shall be made with Myer-type hubs.
 - d. All conduits shall be mounted and supported with 316L stainless steel hardware.
 - e. Conduit composition and protective coating shall be per Sections 3.1 and 3.2.

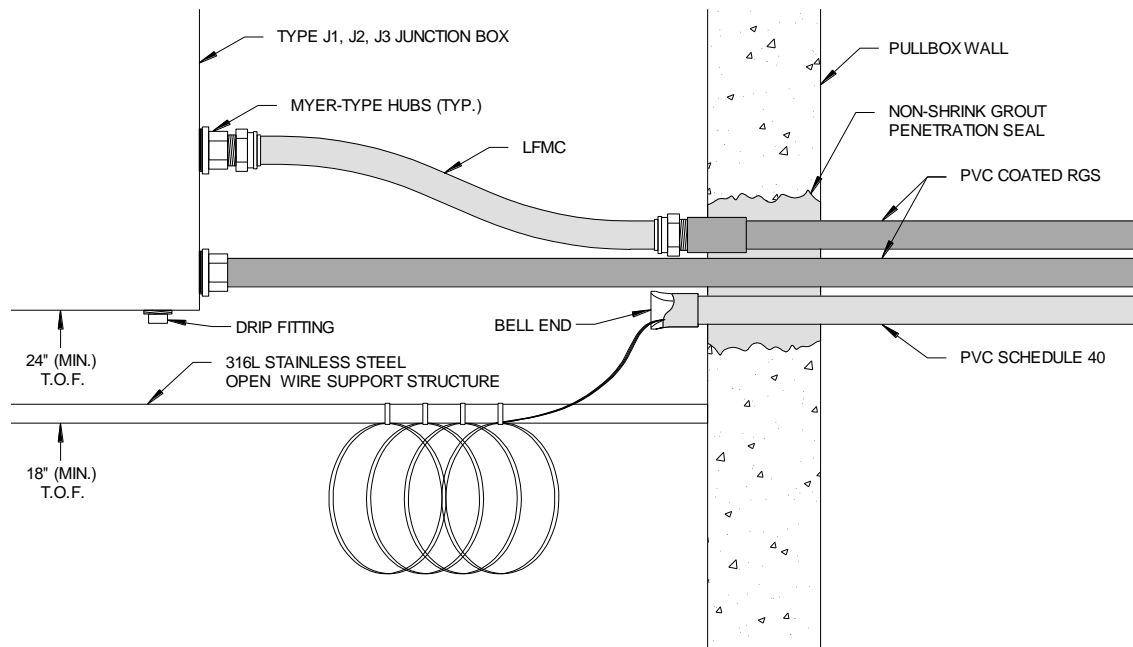


Figure 4.3.B

Typical Conduit Penetrations in Pullboxes

3. Installing Junction Boxes in Pullboxes
 - a. Junction boxes shall be NEMA 4X, 316L stainless steel, 18" x 18" x 6" (minimum) and shall comply with NEC 314.28(A)(1) and 314.28(A)(2).
 - b. Junction boxes shall be mounted with 316L stainless steel hardware at a height of 24 inches minimum from the bottom of the junction box to the floor of the pullbox.
 - c. Junction boxes shall be mounted on separate walls.
 - d. Junction boxes shall be provided with a water drip fitting mounted to the bottom of the box.
 - e. Coil 4 wraps at 12 inches per wrap of each cable and conductor in a junction box.
 - f. Splicing shall not be allowed in junctions boxes.

Exception:

- *Unless specifically called out otherwise in the Plans.*

4. Installing Grounding in Pullboxes

Reference Specification 16060.

4.4 EQUIPMENT VAULTS

A. EQUIPMENT VAULT INSTALLATION

Install vaults for underground raceway systems true to line and grade. Provide a compacted foundation of 3/8-inch minus crushed rock for the support of the vault. The minimum size for the foundation gravel base is 6 inches greater in each direction of the length and width of the vault and 6-inches deep. Ground vaults as per Section 16060-3.

B. EQUIPMENT VAULT CONDUIT INSTALLATION

Reference Figure 4.4.B.

1. All conduits entering an equipment vault shall terminate in a junction box.

Exception:

- *Unless specifically called out otherwise in the Plans.*

2. Conduit composition and protective coating shall be per Sections 3.1 and 3.2.
3. Conduits NOT identified as 100 percent continuous shall change from PVC to PVC-Coated RGS at least 24 inches before entering the equipment vault.
4. Conduits identified as 100 percent continuous shall terminate in a TYPE J1, TYPE J2, or TYPE J3 junction box.
 - a. Provide separate junction boxes for the types of circuits listed below. Under no circumstance shall these circuit types be combined in a common junction box.
 - i. Non-linear power circuits (TYPE J1).

- ii. Intrinsically safe circuits (TYPE J2). Note: intrinsically safe instrumentation and control circuits may be combined in TYPE J2 junction boxes.
 - iii. Instrumentation circuits, not intrinsically safe (TYPE J3).
5. All conduit entries into junction boxes shall be watertight. Conduit entries made into the side or top shall be made with Myer-type hubs.
6. All conduits shall be mounted with 316L stainless steel hardware.
7. Conduits entering an equipment vault shall connect to the equipment through a wall-mounted junction box.
8. Conduits shall enter the vault below the junction box and connect to the box through a conduit “T” with a drain fitting as shown. Moisture from the conduit shall not be allowed to enter the junction box.

Exceptions:

- *Conduits in classified vaults shall be provided with a conduit seal-off fitting and may enter the vault at or above the junction box.*
 - *Conduits in non-classified vaults may enter the vault at or above the height of a junction box if the conduit “T” with drain fitting is replaced with a conduit seal-off fitting. This fitting may be filled with a removable product but shall be properly filled to eliminate the possibility of the passage of water or water vapor.*
9. Seal around all conduit penetrations with non-shrink grout.

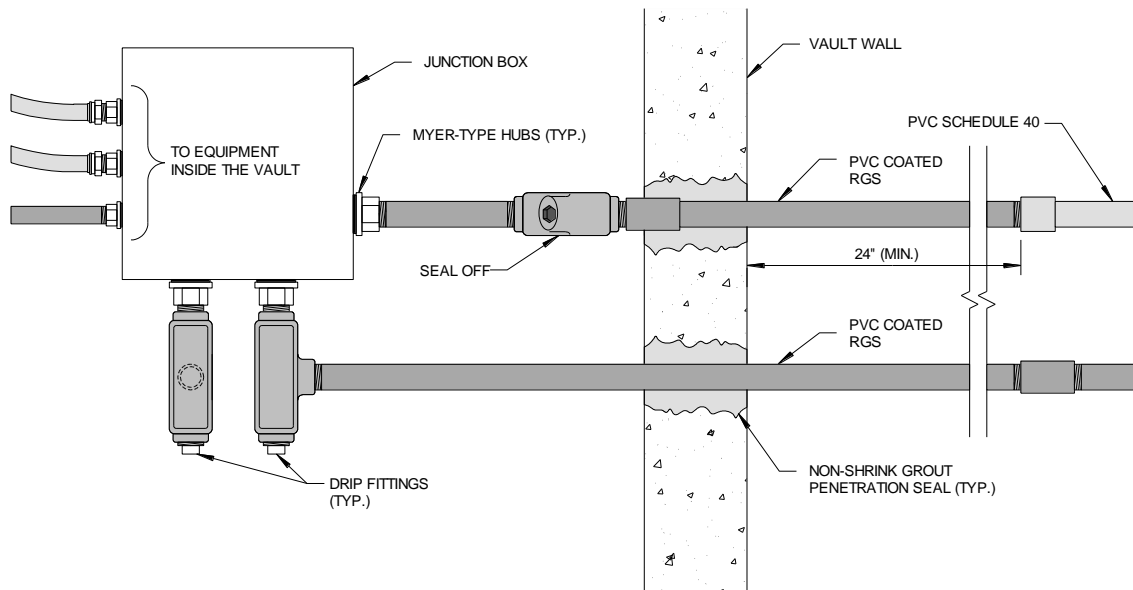


Figure 4.4.B

Typical Conduit Terminations in Equipment Vaults

C. EQUIPMENT VAULT JUNCTION BOX INSTALLATION

1. Junction boxes shall be NEMA 4X, 316L stainless steel, 12" x 12" x 6" (minimum) and shall comply with NEC 314.28(A)(1) and 314.28(A)(2).
2. Junction boxes shall be mounted with 316L stainless steel hardware at a height of 24 inches minimum from the bottom of the junction box to the floor of the vault.
3. Coil 4 wraps at 12 inches per wrap of each cable and conductor in a junction box.

D. EQUIPMENT VAULT GROUNDING INSTALLATION

Reference Specification 16060, Grounding and Bonding.

E. CONNECTIONS TO THE EQUIPMENT

1. LFMC conduit shall be provided from the wall to the equipment.

4.5 HANDHOLES

A. HANDHOLE INSTALLATION

Install handholes for underground raceway systems true to line and grade. Provide a compacted foundation of fine sand or 3/8 minus crushed rock for the bearing surface edges of the handholes.

The handholes shall be installed per the NEC sections 314, and other applicable sections of the NEC.

B. HANDHOLE CONDUIT INSTALLATION

1. End all conduits with a vertical riser.
2. Conduits NOT identified as 100 percent continuous shall be allowed to extend into the handhole as a PVC conduit. Provide a PVC bell-end in each conduit as shown in Figure 4.5.B.2. Provide a removable filler at the end of each conduit to eliminate the possibility of water entry.

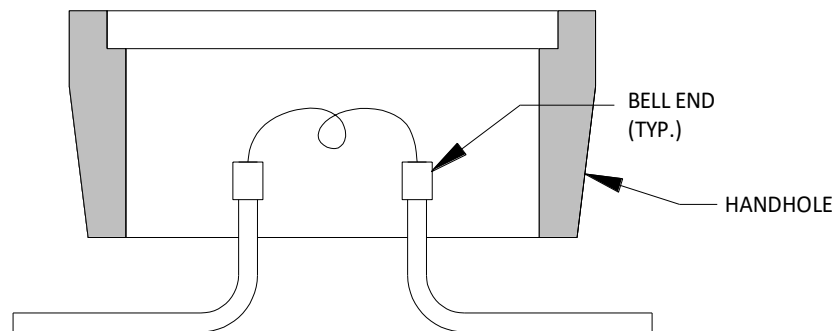


Figure 4.5.B.2

Typical PVC Conduit Terminations in a Handhole

3. Conduits identified as 100 percent continuous shall terminate into the bottom of a TYPE J1, TYPE J2, or TYPE J3 junction box, in PVC-Coated RGS conduit as shown in Figure 4.5.B.3. The door of the J-Box shall face upwards.

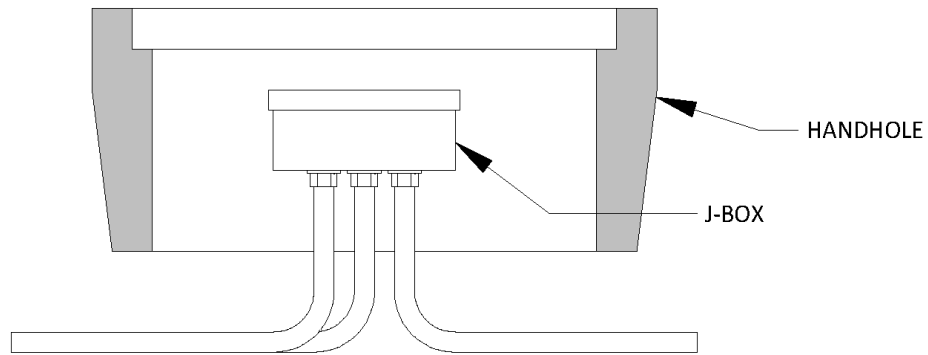


Figure 4.5.B.3

Typical 100 Percent Continuous Conduit Terminations in a Handhole

Exception:

- *Where a handhole contains only two conduits, and is being used solely as a pulling point, where one conduit is simply an extension of the other, a junction box may be replaced with a PVC-Coated RGS conduit pulling body.*

C. HANDHOLE GROUNDING

1. All handholes with metal conduits or with metal lids shall be grounded per Section 16060-3.

4.6 INSTALLATION OF CONDUITS UNDERGROUND AND IN CONCRETE

A. UNDERGROUND RACEWAYS

1. The minimum conduit depth shall be 24 inches.

Exceptions:

- *Electrical utility conduit depth shall be 36 inches.*
- *Unless required otherwise by utility company.*
- *Unless required to be shallower due to physical constraints (see requirements below).*
- *Unless under a concrete slab (see requirements below).*

- *Conduits contains a grounding electrode conductor shall be 30-inches deep.*
2. Conduits that require a buried depth of less than 18 inches shall require a 6-inch-thick concrete covering over that portion of such conduits. Such concrete covers need not be formed but shall be colored red or shall be painted red on top.
 3. Conduits under a concrete slab-on-grade shall be separated from the slab and from the supporting soil by at least 3 inches with soft sand on all sides.
 4. Provide separation of underground instrumentation conduits from power and control conduits by a minimum of 12 inches. Avoid parallel runs of instrumentation conduits with power and control conduits as much as possible. Where instrumentation conduits are required to crossover power or control conduits, maintain the 12-inch separation using depth and make the crossover as close to 90 degrees as possible.

Exception:

- *Provide 18 inches of separation between instrumentation conduits and non-linear power conduits.*
5. Run conduits as straight as practicable. Make changes in direction and/or grade of sufficient length to allow a gradual change (3-foot radius minimum). Make slight offsets with 5-degree couplings.
 6. Run trenches true and clear of stones or soft spots. Place 4-inches of fine sand in the trench bottom and tamp into place. Provide preformed plastic spacers on top of sand spaced 5-feet on center.

After the raceway is placed in the trench, backfill 6 inches with sand, then with native earth backfill passing a No. 8 sieve, free of stones. Do not tamp on top of the conduit until the final backfill is placed. Tamp or water-settle the final backfill to finish the grade. Compact the backfill as specified under Section 02300 "Site Earthwork."

7. Mark direct buried conduit by placing a red marking tape a minimum of 12 inches below grade during backfilling of the trench.
8. Seal conduit connections to eliminate leakage.

B. CONCRETE ENCASED RACEWAYS

Raceways encased in structural concrete must be defined in detail and presented to the Structural Engineer for approval at least 7 days prior to installation. As a minimum, approval will be based on the assurance that there will be no physical interference and that structural integrity will not be jeopardized.

1. In general, conduits encased in concrete may take the most direct route providing they do not jeopardize the structural integrity of the slab or interfere with process-related piping or equipment.
2. Conduits shall be at least 1-1/2 inches to the edge of a concrete body. If a structural block-out is desired for conduit bundling near the edge of a concrete body, then submit the desired layout to the Engineer for approval and design as defined in this Section.
3. Conduit density, crossover, and routing must be minimized and coordinated to assure that structural integrity is not jeopardized.
4. At the point-of-exposure out of the slab, conduits must be perpendicular to the slab surface from all angles.
5. No part of an elbow's bending radius shall be seen at the point-of-exposure from the slab.

C. CONDUITS IN ELEVATED SLABS

See "CONCRETE ENCASED RACEWAYS" above.

D. CONDUITS UNDER SLABS ON GRADE

1. No conduits will be encased in slabs less than 8 inches in depth.
2. For slabs-on-grade, all conduits larger than 3/4-inch trade size must be run underground below the slab.
3. All conduits desired to be installed within slabs on grade shall be submitted to the Engineer for approval and design as defined in this Section.

Exceptions:

- *Conduits shown on the Plans as being designed into slabs on grade do not require further Engineering approval.*

E. CONDUIT TRANSITIONS

Where raceway exits from grade or concrete, provide the following:

1. All conduits exiting grade or concrete shall be PVC-Coated RGS.

Exception:

- *Raceways used for the containment and protection of bare grounding electrode conductors shall be PVC Schedule 80. No portion of these conduits shall be metallic.*
2. For equipment to be moved into place at a later date, install a PVC-Coated RGS coupling flush with the floor slab. Insert a threaded flush plug into the coupling. Provide a pull wire looped backed into the conduit that can be reached after removal of the plug.
 3. Only the straight portion of conduits shall exit grade or concrete. No curved portion of a factory or field-bent conduit shall be visible existing the penetration, even when covered or hidden by equipment.

F. CONDUIT STUB-UPS INTO EQUIPMENT AND ENCLOSURES

1. Where conduits are stubbed up into open bottom equipment and enclosures, extend the bottom of the conduit threads 1/2 inch above grade. Provide ground bushing and end fittings, flush with fitting and 2-inch stub, above the bottom of the enclosure. Stub conduits to a uniform height (plus or minus 1/8 of an inch) and align within plus or minus 1/4 inch.

Exception:

- *Conduits that do not meet the requirements of being 100 percent continuous, stubbing up directly under a Motor Control Center that is mounted on a housekeeping pad, shall be allowed to terminate as a PVC conduit with a bell-end.*

2. Locate stub-ups directly under the section gutter into which the conductors they contain are to be routed. Terminate conduit with insulating, grounding type bushing bonded to the ground bus of the equipment.
3. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends are not visible above the finished slab.
4. Unless otherwise noted on the Plans, spare conduits stubbing up through concrete floors and not adjacent to a wall shall be finished flush with floor with an RGS coupling. Provide an in-set metal plug (male thread) into coupling flush with floor.
5. Unless otherwise noted on the Plans, spare conduits stubbing up through concrete floors or grade, and adjacent to a wall or housekeeping pad shall extend 12 inches above slab/grade. The exterior edge of the conduit shall be a minimum of 1 inch from the wall/pad.
6. All stub-ups shall be provided with pull string.
7. Provide conduit labels on all stub-ups which are not flush mounted.

G. FIBERGLASS/RTR ELBOWS

1. Types of Joints
 - a. Adhesive Joints: When using an adhesive type joint, the manufacturer's instructions should be followed.
 - b. Adhesive for Fiberglass: The adhesive for fiberglass consists of two parts: resin and hardener. The two materials must be combined before they can be used,
2. Recommended Joining Procedures
 - a. Surfaces to be joined should be clean and free from dirt, foreign materials and moisture. Allow Cleaner to evaporate before applying adhesive.
 - b. Adhesive curing time is the time required for the adhesive in the assembled joint to harden. Cure time is dependent on ambient temperature.

4.7 PROTECTION

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures coatings, and finishes are without damage or deterioration at the time of Substantial Completion.

- A. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- B. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

4.8 CLEANING

On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

4.9 QUALITY CONTROL

A. TESTS

- 1. Conduits identified as meeting the requirements of 100 percent continuity shall be tested between source and destination as follows:
 - a. Testing shall be performed using a Digital Voltmeter or Biddle ohmmeter.
 - b. Testing values shall not exceed 5 ohms.
 - c. If testing values exceed 5 ohms, then corrective action shall be taken to reduce the resistance to 5 ohms or below.
 - d. These measurements shall be documented, signed, and submitted to the Engineer for approval.

***** END OF SECTION *****

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the various types of receptacles, connectors, switches, and finish plates.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Items</u>
16050	Basic Electrical Materials and Methods
16130	Raceways and Boxes

1.3 SUBMITTALS

See Section 01300.

1.4 QUALITY ASSURANCE

See Section 16050.

1.5 COORDINATION

A. WIRING DEVICES FOR OWNER FURNISHED EQUIPMENT

Match devices to plug connectors for Owner-furnished equipment.

B. CORD AND PLUG SETS

Match cord and plug sets to equipment requirements.

1.6 DEFINITIONS

Reference Section 16050, "Definitions."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include the following:

1. Wiring Devices
 - a. Arrow Hart Div., Cooper Industries.
 - b. Bryant Electric, Inc.
 - c. Hubbell Inc.
 - d. Killark Electrical Mfg. Co.
 - e. Leviton Mfg. Co., Inc.
 - f. Pass & Seymour/Legrand.
2. Multi-Outlet Assemblies
 - a. Wiremold Co.

2.2 WIRING DEVICES

Comply with NEMA Standard WD 1, "General Purpose Wiring Devices." Terminals shall be rated for 75 degrees C (min.).

A. ENCLOSURES

NEMA 1 equivalent, except as otherwise indicated.

B. COLOR

Ivory except as otherwise indicated or required by Code.

C. RECEPTACLES, STRAIGHT-BLADE AND LOCKING TYPE

Except as otherwise indicated, comply with Federal Specification W-C-596 and heavy-duty grade of UL Standard 498, "Electrical

Attachment Plugs and Receptacles.” Provide NRTL labeling of devices to verify compliance.

1. General Purpose Convenience Outlets
 - a. Duplex receptacle configuration
 - b. Nylon face
 - c. Staked screw terminals for line, neutral, and ground connections.
 - d. Provisions for split bus
 - e. NEMA 5-20R
2. Special Purpose Receptacles
 - a. Staked screw terminals for line, neutral, and ground connections.
 - b. NEMA configuration as indicated.

D. RECEPTACLES, STRAIGHT-BLADE, SPECIAL FEATURES

Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:

1. Ground-Fault Circuit Interrupter (GFCI) Receptacles – Class A (5 mA) Personal Protection

UL Standard 943, “Ground Fault Circuit Interrupters,” with integral NEMA 5-20R duplex receptacle arranged to protect only the connected receptacle and no other receptacles connected on the same circuit. Design units for installation in a 2-3/4-inch-deep outlet box without an adapter.
2. USB Charging Receptacles

UL Listed NEC Class 2 Power Supply integrated into NEMA 5-20R duplex receptacle. Power supply shall feature two USB Type A ports and shall comply with the USB Battery Charging Specification 1.2. Charging output shall be at least 1.5 Amps at each port simultaneously. Power supply shall be FCC Part 15

compliant. Units shall be suitable for installation in a 2-3/4-inch-deep outlet box without an adapter, and shall be compatible with standard GFCI-style faceplates. Leviton T5832 or equal.

E. RECEPTACLES, INDUSTRIAL HEAVY-DUTY

Conform to NEMA Standard PK 4 “Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type for Industrial Use.”

Refer to Specification Section 16230 for pin and sleeve generator receptacles.

F. RECEPTACLES IN HAZARDOUS (CLASSIFIED) LOCATIONS

Comply with NEMA Standard FB 11 “Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations” and UL Standard 1010 “Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.”

120 VAC, 1 PH, 20 A and less, receptacles used in Class I, Divisions 1 and 2 areas, shall be dead-front, delayed action, circuit breaking type, rated for use in Class I, Division 1 and 2, Groups B, C, and D areas. These receptacles shall be rated NEMA 3, 7BCD, 9FG, and 12 and shall be suitable for use in explosion proof, dust-ignition proof, and raintight applications. Receptacles shall be rated 20 A, 125 VAC with 3/4” hubs; Crouse-Hinds #ENR 21201 with ENP 5201 plug; Killark UGR2-20231 with UGP-20231QW plug, or equivalent.

G. CONVENIENCE RECEPTACLES IN WET LOCATIONS

Convenience receptacles in wet locations shall comply with NEC Article 406.9 and shall be 20 A, 125 VAC rated terminated with binding screws.

H. PENDANT CORD/CONNECTOR DEVICES

Matching, locking type, plug and plug receptacle body connector, NEMA L5-20P and L5-20R, heavy-duty grade.

1. Bodies

Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.

2. External Cable Grip

Woven wire mesh type made of high-strength galvanized-steel wire strand and matched to cable diameter and with attachment provision designed for the corresponding connector.

I. CORD AND PLUG SETS

Match voltage, current ratings, and number of conductors to requirements of the equipment being connected.

1. Cord

Rubber-insulated, stranded copper conductors, with type SOW-A jacket. Grounding conductor has green insulation. Ampacity is equipment rating plus 30 percent minimum.

2. Plug

Male configuration with nylon body and integral cable-clamping jaws. Match to cord and to receptacle type intended for connection.

J. SNAP SWITCHES

Quiet-type ac switches, NRTL listed and labeled as complying with UL Standard 20 “General Use Snap Switches,” and with Federal Specification W-S-896.

1. Lighting Switches

120/277 Vac only, rated 20 amperes.

2. Motor Rated Switches

Horsepower rated for application indicated.

K. OCCUPANCY SENSING LIGHT SWITCH

Provide occupancy sensing light switches in all office, lab, kitchen, break rooms, and restrooms.

1. Switches shall be 120/277 V, passive infrared/ultrasonic, commercial grade, white, with adjustable time delay of 30 seconds to 30 minutes, Leviton OSSMT-MDW or equal.

L. WALL PLATES

Single and combination types that mate and match with corresponding wiring devices. Features include the following:

1. Color
Matches wiring device except as otherwise indicated.
2. Plate-Securing Screws
Metal with heads colored to match plate finish.
3. Material for Interior Finished Spaces
Lexan, except as otherwise indicated.
4. Material for Interior Unfinished Spaces: Galvanized steel.
5. Material for Laboratories: Stainless steel.
6. Material for Exterior or Wet Locations: Cast Aluminum.

2.3 MULTI-OUTLET ASSEMBLIES

A. Comply with Standard UL 5, "Surface Metal Raceways and Fittings."

B. COMPONENTS OF ASSEMBLIES

Products of a single manufacturer designed to be used together to provide a complete matching assembly of raceways and receptacles.

C. RACEWAY MATERIAL

Metal, with manufacturer's standard corrosion-resistant finish.

D. WIRE

No. 12 AWG.

PART 3 EXECUTION

3.1 INSTALLATION

A. IDENTIFICATION

Each receptacle, whether convenience, or dedicated, shall be labeled with the circuit from which its power is derived. Label as “CKT-XX” where XX = numerical circuit number.

1. Only one Panelboard servicing the site:

Label as “CKT-XX” where XX = numerical circuit number within the Panelboard.

2. More than one Panelboard servicing the site:

Label as “CKT XX-YY” where XX = Panelboard number and YY = numerical circuit number within the Panelboard.

Example:

A receptacle powered from circuit 03 of Panelboard [01 PB 02] would be labeled “CKT 02-03.”

B. RECEPTACLE BOXES

1. Reference Section 16130 for box types.

2. Mounting Height

- a. Indoor, in DRY Areas

Indoor receptacle boxes in DRY areas shall be mounted 12 inches above the floor unless shown otherwise on the Plans.

- b. Indoor, in WET Areas

Indoor receptacle boxes in WET areas shall be mounted 42 inches above the floor unless shown otherwise on the Plans.

c. Outdoor

Outdoor receptacle boxes shall be mounted 18 inches above grade unless shown otherwise on the Plans.

3. Reference Section 16130 for box cover types.

C. CONVENIENCE RECEPTACLES

Convenience receptacles shall be 20 A, duplex, white, GFCI, straight blade, 3-wire, grounding, unless called out otherwise on the Plans.

In addition to any GFCI requirements, all receptacles, convenience or dedicated, located in break rooms and kitchens shall be AFCI.

D. DEDICATED RECEPTACLES

Dedicated receptacles shall be 20 A, simplex, gray, non-GFCI, straight blade, 3-wire, grounding, unless called out otherwise on the Plans.

In addition to any GFCI requirements, all receptacles, convenience or dedicated, located in break rooms and kitchens shall be AFCI.

Dedicated receptacles shall include a red phenolic placard with 3/8-inch lettering over the receptacle stating:

<p>NON-GFCI RECEPTACLE FOR (<i>specific device</i>) NOT INTENDED FOR GENERAL USE</p>
--

E. ARRANGEMENT OF DEVICES

Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

1. See "Raceways and Boxes" Section for mounting height of devices.
2. Verify locations of outlets and switches in cabinetry with cabinet supplier and Owner prior to installation.

F. INSTALLATION PRACTICES

1. Install devices and assemblies' plumb, level, flush and secure. Provide spacers on device screws to flush yokes or flanges to surface of wall within 1/16 of an inch where boxes are not flush with the wall surface. Install wiring devices such as receptacles to withstand 50 pounds force applied perpendicular to the device face with a maximum deflection of 1/16 of an inch.
2. Protect devices and assemblies during painting.
3. Use corrosion resistant devices in kitchen areas and outdoors.
4. Wiring connections shall be made by compression on the screw terminals. The wire shall be neatly and symmetrically wrapped around the screw a minimum of 180 degrees.

G. LIGHT SWITCH ORIENTATION

Install switches with the "off" position down. Install three and four way switches so the load is "off" when all switch handles are down.

H. TERMINATION PRACTICES

Connect phase, neutral, and grounding wires to devices with full loops around screws installed to tighten with tightening of the screw. Trim insulation to within 1/8 of an inch of screw terminal.

I. WALL PLATES

Install after painting is complete. Install with an alignment tolerance of 1/16 of an inch to plumb. Install at flush mounted devices so that all four edges are in continuous contact with finished wall surface without the use of mats or similar devices. Do not use plaster fillings.

3.2 GROUNDING

Connect receptacle or switch ground lug to device box for devices other than isolated ground type.

3.3 FIELD QUALITY CONTROL

Test wiring devices for proper connections, polarity, and ground continuity. Perform this testing with testing equipment designed for testing polarity and connections.

Operate each operable device at least six times.

Demonstrate charging the owner's electronic devices at each USB receptacle.

Test ground-fault circuit interrupter operation with local fault simulations, using a tester designed for such testing, and according to manufacturer recommendations. Testing with integral test switches on the receptacle is not sufficient for this testing.

Replace damaged or defective components, and retest.

***** END OF SECTION *****

SECTION 16210

ELECTRICAL UTILITY SERVICES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of electrical service and connection to the commercial power utility system (Power Company) and the work required in conjunction with the Power Company for their revenue metering. For this project the Power Company is Mason County PUD No. 3.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Items</u>
01500	Temporary Facilities
16050	Basic Electrical Materials and Methods
16060	Grounding and Bonding
16120	Conductors and Cables
16130	Raceway and Boxes

PART 2 PRODUCTS

2.1 MATERIALS

- A. Primary circuit to utility transformer, including vaults conduit, primary cable and utility transformer: provided by the Power Company.
- B. Current transformer and revenue metering: provided by the Power Company.
- C. Meter socket, current transformer enclosure, and connecting conduit: provided by the Contractor.

PART 3 EXECUTION

3.1 APPLICATION

The Contractor shall make application for service to the Power Company on the Owners behalf. A lump sum bid item has been added to the bid proposal for purposes of bid evaluation. Contractor shall be paid the actual invoice cost from the Power Company.

SECTION 16230

GENERATOR ASSEMBLIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of a packaged liquid-propane fueled engine generator set [03 GEN 01] with accessories as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01550	Generator Engine Exhaust System
16050	Basic Electrical Materials and Methods
16060	Grounding and Bonding
16410	Enclosed Switches and Circuit Breakers

1.3 DEFINITIONS

A. FULL LOAD

The generator delivering 100 percent of its rated output power.

B. MAXIMUM FREQUENCY DIP AND PEAK

The maximum allowable frequency deviation, in percent, below and above the generator's specified output frequency during application-specific starting and stopping steps as specified in 1.5.

Example: A 10 percent MAXIMUM FREQUENCY DIP AND PEAK on a 480 Vac, 3 PH, 60 Hz generator equates to ± 10 percent (± 6 Hz) maximum deviation from 60 Hz, or 54 Hz absolute minimum to 66 Hz absolute maximum frequency limits during the worse-case specified step changes while either loading or unloading.

C. MAXIMUM FREQUENCY RECOVERY TIME PERIOD

The maximum period of time, in seconds, for the frequency to recover back to its specified steady-state operating band following load transitions from no load to full load or from full load no load.

Example: A 5 second MAXIMUM VOLTAGE RECOVERY TIME PERIOD requires that the generator repeatedly recover from full load added or removed load steps within 5 seconds maximum. This means that during a full load transition, in either direction, the generator frequency may deviate from its specified steady-state operating band for a maximum of 5 seconds before it has fully recovered back to its specified steady-state operating band.

D. MAXIMUM STEADY-STATE FREQUENCY OPERATING BAND

The maximum allowable frequency deviation, in percent, below and above the generator's specified operating frequency during steady-state operating conditions at any load between no load and full load.

Example: 0.5 percent MAXIMUM STEADY-STATE FREQUENCY OPERATING BAND on a 480 Vac, 3 PH, 60 Hz generator equates to ± 0.5 percent (± 0.3 Hz) maximum deviation from 60 Hz, or 59.7 Hz absolute minimum to 60.3 Hz absolute maximum frequency limits at any stable operating load from no load to full load.

E. MAXIMUM VOLTAGE DIP AND PEAK

The maximum allowable voltage deviation, in percent, below and above the generator's specified output voltage during application-specific starting and stopping steps as specified in 1.5.

Example: 25 percent MAXIMUM VOLTAGE DIP AND PEAK on a 480 Vac, 3 PH, 60 Hz generator equates to ± 25 percent (± 120 Vac) maximum deviation from 480 Vac, or 360 Vac absolute minimum to 600 Vac absolute maximum voltage limits during the worse-case specified step changes while either loading or unloading.

F. MAXIMUM VOLTAGE RECOVERY TIME PERIOD

The maximum period of time, in seconds, for the voltage to recover back to its specified steady-state operating band following load transitions from no load to full load or from full load no load.

Example: A 5 second MAXIMUM VOLTAGE RECOVERY TIME PERIOD requires that the generator repeatedly recover from full load added or removed load steps within 5 seconds maximum. This means that during a full load transition, in

either direction, the generator voltage may deviate from its specified steady-state operating band for a maximum of 5 seconds before it has fully recovered back to its specified steady-state operating band.

G. MAXIMUM STEADY-STATE VOLTAGE OPERATING BAND

The maximum allowable voltage deviation, in percent, below and above the generator's specified operating voltage during steady-state operating conditions at any load between no load and full load.

Example: 2 percent MAXIMUM STEADY-STATE VOLTAGE OPERATING BAND on a 480 Vac, 3 PH, 60 Hz generator equates to ± 2 percent (± 9.6 Vac) maximum deviation from 480 Vac, or 470.4 Vac absolute minimum to 489.6 Vac absolute maximum voltage limits at any stable operating load from no load and full load.

H. NO LOAD

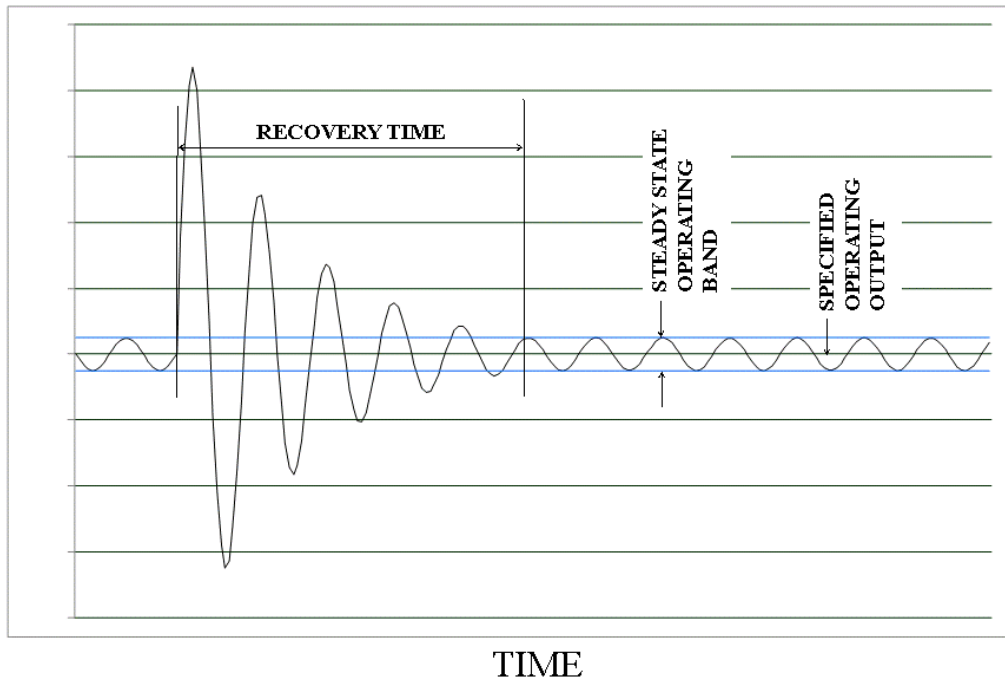
The generator delivering 0 percent of its rated output power.

I. STANDBY POWER OUTPUT RATING

The power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of an electrical utility power outage. The power output rating is the gross electrical power output of the generator set minus the total power requirements of the electric motor driven cooling fan, water pump, and other auxiliary loads related to the generator set operations.

J. DEFINITIONS REFERENCE GRAPH

The following graph is a reference chart to better define the following terms "MAXIMUM VOLTAGE RECOVERY TIME PERIOD," "MAXIMUM STEADY-STATE VOLTAGE OPERATING BAND", "MAXIMUM FREQUENCY RECOVERY TIME PERIOD," and "MAXIMUM STEADY-STATE FREQUENCY OPERATING BAND." The Y axis can either be voltage or frequency and the X axis is time.



1.4 REFERENCES

- A. The latest Washington State adopted, published edition of a reference shall be applicable.
- B. All Washington State amendments adopted prior to the effective date of this Contract shall be applicable.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. National Fire Protection Association (NFPA)
 - a. NFPA 58 Liquefied Petroleum Gas Code
 - b. NFPA 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
 - c. NFPA 70 National Electrical Code
 - 2. International Fire Code (IFC)
 - 3. International Building Code (IBC)

4. National Electrical Manufacturers Association (NEMA)
 - a. NEMA MG 1: Motors and Generators
5. International Mechanical Code (IMC)
6. Underwriters Laboratory (UL)
 - a. UL 2200 Generator Engine Generator Assemblies
 - b. UL 142 Steel Aboveground tanks for Flammable and combustible Liquids.

1.5 PERFORMANCE REQUIREMENTS

- A. Engineering calculations indicate a standby power output rating requirement of 120 kW at 80 percent power factor at 480/277 volts, 3 phase, 60 hertz while operating under the site conditions listed in Part 1.8 of this Section in an ambient temperature range of 0 to 104 degrees F at less than 95 percent rated capacity. The manufacturer shall calculate generator unit size according to the following bus rated loads and starting steps:

Step No./ Device No.	Device Description	Motor Code	Load Hp	Load kVA	Starter Type	No. of Pulses VFD only)
Step 1						
01 XFMR 01	Transformer, 480-208/120 V, 3 ph	-	-	15	-	-
01 MTR 01	Well Pump	H	7.5	-	FVNR	-
Step 2						
02 MTR 01	Motor, Duty Pump No. 2	-	15	-	VFD	6
02 MTR 03	Motor, High Flow Pump No. 1	-	20	-	VFD	6
02 MTR 04	Motor, Backwash	N	0.5	-	FVNR	-
Step 3						
02 MTR 02	Motor, Duty Pump No. 2	-	15	-	VFD	6
02 MTR 06	Motor, High Flow Pump No. 2 (future)	-	20	-	VFD	6

- B. The Generator shall be suitable for operation with pulse width modulated variable frequency drives (connected as loads as shown on the Plans and operating motors throughout a speed range of 6 to 60 hertz) without detrimental effects on voltage or frequency regulation and stability.

C. MAXIMUM VOLTAGE DIP AND PEAK

Shall not exceed 25 percent.

D. MAXIMUM FREQUENCY DIP AND PEAK

Shall not exceed 10 percent.

E. MAXIMUM STEADY-STATE VOLTAGE OPERATING BAND

Shall not exceed 2 percent.

F. MAXIMUM STEADY-STATE FREQUENCY OPERATING BAND

Shall not exceed 0.5 percent.

G. MAXIMUM VOLTAGE RECOVERY TIME PERIOD

Shall not exceed 5 seconds.

H. MAXIMUM FREQUENCY RECOVERY TIME PERIOD

Shall not exceed 5 seconds.

I. ALTERNATOR OUTPUT WAVEFORM

At no load, harmonic content measured line-to-line or line-to-neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, does not exceed 50.

J. SUSTAINED SHORT-CIRCUIT CURRENT

For a 3-phase, bolted short circuit at the system output terminals, the system will supply 300 percent of rated full load current for not less than 10 seconds to coordinate circuit breaker tripping. This system shall include over-voltage relay protection to preclude damage to any generator system component.

K. TEMPERATURE RISE OF GENERATOR

Within limits permitted by NEMA MG 1, when operating continuously at full nameplate rating, the temperature rise of the generator shall not exceed 250 degrees F over 100 degrees F ambient.

L. STARTING TIME

The maximum allowable time period to cold start the generator, while operating at the low end of the specified temperature range, and have its voltage and frequency sufficiently stable for a transfer switch to accept or automatically initiate a power transfer, shall be 10 seconds.

1.6 SUBMITTALS

For each generator set submit under provisions of Section 01300 and as specified herein.

A. PRODUCT DATA

Provide the manufacturer and a full description of the generator set and associated components. Include features, ratings, and performance including, but not limited to:

1. Engine including the following:
 - a. Horsepower at rated speed and load
 - b. Emission Ratings
 - c. Lubrication oil capacity
2. Overall dimensions of generator set system including the sub-base fuel tank, and the enclosure.
3. Fuel consumption for 1/4, 1/2, 3/4, and full load of generator set
4. Electrical governor
5. Coolant heater
6. Alternator
 - a. Electrical rating (kVA, reactance, time constants, temperature rise, etc.).
7. Voltage regulator type, make, model, and wiring diagram
8. Noise levels at twenty-three feet (7 meters) in a free field
9. Exhaust pipe and muffler sizing backpressure calculations

10. Warranty and Service Agreement documentation
11. Vibration isolation calculations, Plans and seismic certification from manufacturer per the seismic information listed in Part 1.8B of this Section.
12. Bill of Materials
13. Wiring Diagram

B. QUALITY ASSURANCE

Provide documentation showing all CD&Es (compliances, deviations, and exceptions) for this Specification.

C. GENERATOR SIZING CALCULATIONS

Submit calculations showing that the submitted generator's standby power output rating is capable of meeting the specified loads in the specified steps listed. The calculations shall show that the generator meets the specified performance requirements.

D. OPERATION AND MAINTENANCE MANUAL

1. Field Test Reports

Indicate and interpret test results for compliance with manufacturer's published standards for unit provided. Provide written approval of installation in accordance with all manufacturers' recommendations.

2. Operation and Maintenance Data

Provide information to be included in the operation and maintenance equipment manuals specified in Section 01300, Section 11000, and as specified herein.

3. Test Reports

The O&M manual shall include a copy of the factory test data and the field test report.

4. Service Agreement and Warranty

Include copies of the Service Agreement and Warranty in the Operation and Maintenance Manual.

1.7 QUALITY ASSURANCE

See Section 16050.

A. SOURCE LIMITATIONS

1. Obtain engine generator set from a single supplier with responsibility for the complete system. Furnish a new product built from components with proven reliability and compatibility. The generator set shall be coordinated to operate as a unit as evidenced by records of prototype testing by the OEM.
2. The warranty shall be supported by the original distributor, not offset to an engine manufacturer, an alternator manufacturer, or a new manufacturer's distributor.

B. PRODUCT SELECTION FOR RESTRICTED SPACE

The site and building are designed around the approved generator sets. This includes sizing of fuel tanks, proper airflow, NEC clearance requirements, and access space. The Contractor, in concurrence with the Engineer, shall make all changes necessary required to meet the design requirements when submitting on an alternate generator at no additional cost to the Owner.

C. Generator set to be UL 2200 listed "Stationary Engine Generator Assemblies."

D. EMISSIONS

EPA certified for all current EPA emissions requirements.

E. FACTORY TEST

Test assembled generator set at the factory prior to shipment to the job site. The power factor for the factory test shall be at 0.8 p.f.

1. Show the following conditions at load and no load on the Generator Set: Charging System Volts, Voltage Output, Frequency, Coolant Temperature, and Oil Pressure, and other

pertinent information on the test report. Provide a plot of the transient voltage and a plot of the frequency response versus time as a result of a full load single step.

2. Perform manufacturer's standard factory tests.
3. Test for a minimum of 30 minutes at full load per NFPA 110.

F. REGULATORY REQUIREMENTS

1. The NEC defines the following items:
 - a. Article 700 – EMERGENCY SYSTEMS
 - b. Article 701 – LEGALLY REQUIRED STANDBY SYSTEMS
 - c. Article 702 – OPTIONAL STANDBY SYSTEMS
2. For this project the installation shall meet all requirements of an NEC 702 system. Generator shall be provided with all options and features required for installation as part of this system.

1.8 PROJECT/SITE CONDITIONS

A. ENVIRONMENTAL REQUIREMENTS

Engine generator system is designed, engineered, and rated to withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 5 degrees F to 122 degrees F.
2. Relative Humidity: 0 to 95 percent.
3. Elevation: Sea level to 500 feet.

B. SEISMIC REQUIREMENTS

The entire generator package including all mounted accessories shall comply with the requirements of the latest editions of 2021 IBC and of ASCE 7-16 Minimum Design Loads for Building and Other Structures, Chapter 13 "Seismic Design Requirements for Nonstructural Components," as referenced and amended by the IBC. Seismic design parameters are as follows:

1. Risk Category IV, Seismic Design Category D.
2. Component Importance Factor: $I_p = 1.5$.
3. Design response acceleration parameters:
 - a. $S_{DS} = 1.204g$.
 - b. $S_{D1} = 0.541g$.

1.9 WARRANTY AND MAINTENANCE

A. WARRANTY

1. The manufacturer shall warrant the materials and workmanship of the generator set for a minimum of 5 years, or 2,500 hours from the registered commissioning and startup.
2. The warranty shall be comprehensive and shall include all components included in the generator package. No deductibles shall be allowed for travel time, service hours, repair part costs, etc., during the warranty period.

B. 2-YEAR MAINTENANCE SERVICE

Beginning at time of Substantial Completion, provide 24 months full maintenance service performed by qualified service technicians of the manufacturer's designated service organization. Include quarterly inspections to check for defects and operational abnormalities. Include routine preventive maintenance (oil changes, filter changes, belt adjustments, etc.) as recommended by the manufacturer and perform adjustments as required to bring the generator performance back into compliance with the original specifications. Provide OEM parts and supplies to complete all service to support all factory warranty requirements with written reports to the Owner upon completion of visits. No deductibles shall be allowed for travel time, service hours, repair part costs, etc., during the warranty period.

Provide a 2-hour load bank test on the generator at 11 months and 23 months from the time of Substantial Completion.

1.10 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. APPROVED MANUFACTURERS

1. Kohler as provided by Power Systems West.

No other manufacturers, and/or distributors shall be considered for this project.

2.2 ENGINE

A. FEATURES

1. The engine shall be specifically designed for use with the specified fuel type.
2. Engine speed shall be governed by an electronic governor. Refer to frequency requirements specified earlier in this Specification.

B. COMPONENTS

1. Oil Pump

Gear type lubricating oil pump for supplying oil under pressure to main bearings, crankpin bearings, pistons, piston pins, timing gears, camshaft bearings, and valve rocker mechanism.

2. Oil Filters

Full flow oil filters conveniently located for servicing, with a spring-loaded bypass valve to ensure oil circulation.

3. Air Filter

Dry type air filter.

4. Cooling System

Sufficient to cool the engine when the generator set is delivering full rated load in an ambient temperature of 104 degrees F.

- a. Engine-driven, centrifugal-type water circulating pump.

- b. Thermostatic valve.
5. Coolant/ Jacket/ Block Heater
- As described in Part 2.6-B of this Section.
6. Electrical starters sufficient to start the engine within 10 seconds of call to start.
7. Batteries
- Lead acid batteries shall be of sufficient capacity to permit starting the generator engine a minimum of four times without recharging. Batteries are to be mounted in an earthquake- and drip-proof rack on the skid, frame, or other approved separate location with required connections provided.
8. Battery Heater
- As described in Part 2.6-B of this Section.
9. Battery Charger
- a. Silicone rectifier static type, self-regulated with high current and full float operation with a filtered output.
 - b. The charger shall be capable of providing a 10 A DC high current charging rate when the battery voltage is below the “float voltage set point.” Full floating charging when voltage is above the set point.
 - c. Battery charger operates from 120 volts, single phase AC connected to Generator Auxiliary Device Panel (GADP) as per Section 2.6.A.
 - d. The charger shall be complete with voltmeter, ammeter, charging rheostat, automatic equalizing timer, and high/low battery voltage alarm.
 - e. The battery charger shall be factory mounted with vibration isolators to prolong service life.
 - f. Battery charger shall include standard NFPA outputs where generator is legally required for life safety.

10. Provide watertight flex connections for all conduits and piping attached to generator.
11. LPG Vaporizer
12. Dry Fuel Filter

2.3 ALTERNATOR

- A. Four pole, 1,800 rpm revolving field generator.
- B. Enclosure shall be of drip-proof construction.
- C. Insulation Class H.
- D. Wiring shall be 12-lead, reconnectable, and configured for the specified voltage, phasing, neutral point, and frequency.
- E. ALTERNATOR HEATER

As described in Part 2.6-B of this Section.

2.4 VOLTAGE REGULATOR

An electronic voltage regulator shall be provided.

2.5 CONTROL PANEL

The Control panel shall be of the rotatable dead-front type, vibration free mounted on the generator set. The generator control panel and the generator main circuit breaker shall be installed per NEC clearances and provide accessibility to equipment. The tops of control panels and the circuit breakers shall be mounted a maximum of 72 inches above the finished floor.

- A. The control panel shall operate at 12 or 24 VDC from the generator/battery electrical system as required by manufacturer based on the size of the system.
- B. Control panel shall include the following functions/devices:
 1. Automatic Starting System
 - a. Provides three 15 second cranking cycles and two rest periods followed by a lockout and alarm.

- b. Operation is initiated by the closing of a remote Form A contact in the automatic transfer switch control circuit.
2. Indicating light for alarm condition.
3. Indication for the following:
 - a. Running
 - b. Low coolant level
 - c. High coolant temperature
 - d. Low oil pressure
 - e. Over speed
 - f. Over crank
 - g. AC volts for each phase
 - h. AC current for each phase
 - i. Frequency
 - j. Lube oil pressure
 - k. Coolant temperature
 - l. Run Time
 - m. Number of Starts
4. Engine “AUTO-OFF-MANUAL” control selector switch.
5. Red colored emergency shutdown pushbutton/switch.
6. Time delay relay to permit operation at “NO-LOAD” after retransfer of load to normal source (cool down timer).
7. Automatic safety controls which shut down the engine on:
 - a. Low lubricating oil pressure

- b. Low coolant level
 - c. High jacket water temperature
 - d. Engine over speed
8. Include a Form A (N.O. Dry) contact for remote connection for each of the following Generator functions.
- a. Running
 - b. General Alarm
 - c. Fail (shall include, as a minimum, any combination of conditions in 8 above)
 - d. AUTO-OFF-MANUAL control switch in Auto Mode
 - e. Low Battery Voltage
 - f. Low Oil Pressure
 - g. High Coolant Temperature
 - h. Low Fuel Level
 - i. High Fuel Level or Pressure
9. Control Cabinet Heater

As described in Part 2.6-B of this Section.

2.6 ACCESSORIES

A. GENERATOR AUXILIARY DEVICE PANEL

The generator manufacturer shall provide, install, and prewire a Generator Auxiliary Device Panel (GADP) as part of the generator system with the following minimum features:

- 1. The GADP shall consist of a NEMA 1 gasketed 240/120 VAC single phase load center with a main breaker and appropriately sized branch circuit breakers for the battery charger and the heaters listed below under GENERATOR HEATERS. Available power to the panel may be 240/120 VAC or 208/120 VAC, single phase.

Exception:

The GADP load center can be replaced with one or more 20 A, 4-plex receptacle sets in cast aluminum boxes under the following conditions:

- a. The battery charger and all heater loads are 120 VAC, single phase,*
 - b. The sum of the battery charger and all heater loads does not exceed 1920 VA (16 A),*
 - c. All loads are prewired by the manufacturer with grounded plug cables,*
 - d. The receptacles are placed within reach of all load plugs,*
 - e. If required, multiple 4-plex receptacle sets are connected together by the manufacturer (provide a single electrical connection point for the Contractor).*
2. For outdoor generators, the GADP shall be securely mounted within the enclosure in a location easily accessible by the operator and to a Contractor-provided power conduit.
 3. The GADP shall be internally connected to the described loads by the generator manufacturer.
 4. It is the intent that the Contractor need only provide a single power conduit and associated conductors to the manufacturer-provided GADP and terminate the conductors to a main circuit breaker, neutral, and ground. All connections for heater controls and devices shall be prewired and pretested by the manufacturer.

B. GENERATOR HEATERS

1. Coolant Heater

Engine mounted, thermostatically controlled immersion type engine coolant heater to ensure a minimum coolant temperature of 120 degrees F at ambient room temperature of 5 degrees F. Provide as shown in the table below.

Provide the following generator set heaters:

Device	Voltage Configuration	Wattage (W)
Coolant Heater	208V 1ph or 120V	~1,500

C. CIRCUIT BREAKERS

1. Provide an output main circuit breaker according to the plans and specifications section 16410. This breaker shall be lockable in its open position. The breaker shall have an auxiliary contact that is open when the breaker is in the open position. This circuit shall be prewired by the generator manufacturer to dedicated terminals in the generator control panel. Wire between these devices in LFMC conduit.
2. Provide a generator field protection circuit breaker, or other means to protect the alternator.
3. Provide a load bank circuit breaker according to the plans and that meets specification section 16410.

D. DECALS, PLACARDS, AND SIGNS

1. The generator manufacturer shall provide all decals and signage as required by the regulatory and/or inspecting agency for the particular installation, including, but not limited to the following:
 - a. One hazardous material placard, diamond shape, 4 color (red, white, blue, yellow) with numbers 240 (Propane) in accordance with NFPA 704.
2. The Contractor shall provide the following in an easily viewable location on the fuel tank unless noted otherwise:
 - a. One 3" x 12" decal labeled "Propane" (black/white).

E. SPRING ISOLATORS

Provide spring isolators for all generators 500 kW and larger.

F. ANCHORS

Anchors used to secure the generator to the base or other stable surface shall be designed and sized by the manufacturer. Anchors shall be cast-in-place 316 stainless steel anchor bolts or drilled-in 316 stainless steel anchors set with epoxy adhesive. Expansion type anchors shall not be acceptable. The Contractor shall provide and install these anchors.

2.7 EXHAUST SYSTEM

A. Sufficiently sized to ensure against loss of power due to excessive backpressure in accordance with engine manufacturer's recommendations. Include a drain plug and drip leg in low point of exhaust piping to protect engine. Terminate exhaust piping with a rain cap.

B. The exhaust systems shall be mounted inside the enclosure.

C. FLEX CONNECTION

Provide a stainless-steel flexible exhaust connector, with an exhaust temperature test fitting, flanged for service disconnection.

D. SILENCER

Provide a critical grade silencer. Silencer construction shall be steel with high temperature paint or aluminized finish.

2.8 ENCLOSURE

A. ACOUSTICAL ENCLOSURE

The Generator [03 GEN 01] shall be provided with a skintight acoustical weather protective enclosure.

1. The enclosure shall reduce the sound pressure level of the generator set while operating at full rated load to an average of 65 dBA at any location 23 feet (7 meters) from the generator set in a free field environment.

2. The enclosure shall have hinged access doors to maintain easy access for all operating and service functions. All hardware and hinges shall be stainless steel. All doors shall be lockable and include retainers to hold the door open during servicing. The roof shall be cambered to prevent the accumulation of water. The roof

and walls shall be designed to withstand snow and wind loads per the IBC.

3. All sheet metal shall be primed for corrosion protection and finish painted with a color chosen by the Owner from the manufacturer's standard options.
4. The air intake and exhausts shall be sized to provide ample airflow for the generator set operation at rated load in ambient temperature of 100 degrees F.

2.9 FINISH

The entire standby generator set assembly with accessories is to be factory painted, color chosen by Owner from manufacturer's standard colors. Generator set manufacturer shall provide appropriate epoxy/polyurethane coating system for high heat conditions.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards. Field repair of material or equipment made defective by improper storage or site construction damage by other trades may be cause for rejection of installation.

3.2 PROPANE FUEL VENDOR

The District's propane fuel vendor is Peak Propane, (360) 463-1381. Peak propane will provide and install the propane fuel tank, and fuel lines and accessories from the fuel tank to the generator.

The Contractor shall be responsible for coordinating and scheduling the propane fuel vendor's work, shall coordinate the location of the fuel stub up into the generator enclosure, and shall provide all earthwork trenching and backfill for the buried fuel lines.

3.3 INSTALLATION

- A. Install the complete generator set and accessories per the manufacturer's installation instructions.
 - 1. Anchor the generator set to concrete housekeeping base or pad with high strength anchors and adequate penetration suitable for the Seismic Design Category as specified in the Plans.
 - 2. Make all electrical connections between accessory items, which are not factory wired, prior to requesting the test engineer.
- B. Maintain minimum workspace around unit and components per manufacturer's installation shop plans and NFPA 70 NEC.
- C. Provide a complete fill of lubricating oil.
- D. Provide a complete fill of propane fuel in remote storage tank before testing.
- E. Provide a complete fill of manufacturer approved antifreeze (ethylene-glycol) and water to protect the engine and heat exchanger cooling system to minus 25 degrees F.
- F. Contractor shall locate generator control panel and the generator main circuit breaker per NEC clearances and provide accessibility to equipment. Neither shall be mounted more than 72 inches above the floor. Include all costs associated with relocating the standard control/service panel arrangement on generator set to maintain code requirements in the Bid Cost.
- G. The generator set shall not be started up or tested in the field until all exhaust piping has been insulated as specified and shown on the Plans. All intake and exhaust louvers and fuel system components shall be fully functional.

3.4 IDENTIFICATION

Identify field installed wiring, components, and provide warning signs as specified in Section 16050.

3.5 GROUNDING

Provide ground continuity to facility electrical ground system as indicated in the Plans and Specification 16060.

3.6 FIELD QUALITY CONTROL

A. Provide services of a factory authorized service representative to provide inspection results of field visit and field testing in writing.

B. TESTING AGENCY

Provide the services of a qualified independent testing agency to perform specified field quality-control testing.

C. TESTING

1. Prior to Energization

After installing disconnect switches and circuit breakers, perform visual and mechanical inspection of enclosure and devices.

2. Provide third party breakers testing per Specification 16050, Section 3.

Check connections and mounting for proper torque.

Correct or replace malfunctioning units and retest.

Remove any burrs, filings, or other foreign materials from enclosure. Completely wipe down and vacuum enclosure.

3. After Energization

After electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

D. FIELD TEST

Test the assembled generator set after installation at the job site is complete.

1. Advise the Engineer, the Integrator, the Contractor, the local Fire Prevention Inspector, and the Owner of the proposed time and date

of the field test at least 2 weeks in advance so that the test may be witnessed if desired.

2. Under supervision of a factory authorized service representative, pretest all system functions, operations, and protective features. Provide all instruments and equipment required for tests. Adjust to ensure operation is according to specifications.
3. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations and these specifications under the environmental conditions present and expected.
4. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include, but not be limited to: all electric heaters, battery charger(s), etc.
5. Cold Start Test
 - a. The unit shall demonstrate the ability to start from a "cold" standby condition (i.e., normal standby mode with engine coolant temperature established by properly functioning water-jacket heater).
6. Calibration and PLC Signal Status Check
 - a. Calibrate all sensors and instruments.
 - b. Verify the scaling and connections of each signal to the terminal strip identified in the plans.
7. Generator Load Testing
8. Generator load testing shall be provided using a manufacturer-provided temporary load bank at 1.0 power factor. The generator shall be operated at 50 percent of full load rating for thirty minutes, followed seamlessly by thirty minutes at 80 percent of full load rating, followed seamlessly by one hour at 100 percent full load rating.
9. After the first 15 minutes at full load, the following shall be recorded at 15-minute intervals (four recordings).
 - a. Voltage (phase to phase and phase to ground) and phase rotation

- b. Amperage (each phase)
- c. Frequency
- d. Fuel pressure, oil pressure, and water temperature
- e. Exhaust gas temperature at engine exhaust outlet
- f. Ambient temperature

During the load test period, check for exhaust leaks, path of exhaust gases outside the building or enclosure, cooling air flow, movement during starting and stopping, vibration during 80 percent and 100 percent loading.

A certified copy of the test results shall be given to the Engineer and supplied with the O&M manuals.

- 10. The Contractor shall demonstrate the backup power system is fully functional by simulating power outages. Provide 14 days written notice.
 - a. Coordinate phase rotation prior to transferring power.
 - b. Power outages shall be simulated to the extent allowed by the process as determined by the Owner. Any process areas or loads not directly associated with the Contractor's scope of work, but connected to the generator being tested, will be turned on/off by the Owner.
 - c. In the event that the installed generator assembly is unable to start and operate the specified loads, at a minimum:
 - i. Document the generator's output voltage current, and frequency during the demonstration including the point of failure.
 - ii. Provide written descriptions of the general conditions encountered during the demonstration and any field diagnostic actions performed.
 - iii. Document the changes, if any, between the test conditions and the table provided in section 1.5 Performance Requirements

iv. Provide recommendations to remedy the failed test.

11. Refill the remote fuel tank after completion of field testing.

E. RETEST

Correct deficiencies identified by field tests and observations, and retest until specified requirements are fully met.

3.7 TRAINING

A. The manufacturer of the generator set shall conduct specifically organized training sessions covering operation and maintenance of the unit 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 unit. 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
8. Fuel and monitoring system
9. Spare parts that have been provided

B. At least one training session, at least 3 hours in duration, shall be conducted at the site after startup of the system. The manufacturer shall prepare and assemble specific instruction materials for each training session and shall supply such materials to the Owner at least 2 weeks prior to the time of the training.

3.8 FINAL ADJUSTMENTS

- A. Adjust voltage and frequency output of generator set to nominal ratings and mark gauges with plastic pen for normal, operation references for Owner.
- B. Adjust time response of control system to meet site performance requirements.
- C. Check all remote connections again for proper tightness.

3.8 CLEANING

Upon completion of installation and startup, inspect engine generator set. Remove paint splatters, other spots, dirt, and debris. Perform touchup painting to cover scratches and marks to finish. Match original finish of generator set.

***** END OF SECTION *****

SECTION 16410

ENCLOSED SWITCHES, FUSES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of individually mounted switches and circuit breakers used for the following:

- A. Feeder and equipment disconnect switches
- B. Feeder and branch-circuit protection
- C. Motor safety disconnect switches

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Sections</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods
16140	Wiring Devices

1.3 SUBMITTALS

Submit under the provisions of Section 01300.

Manufacturer's Product Data for disconnect switches, circuit breakers, and accessories specified in this Section.

Maintenance data for tripping devices to include in the operation and maintenance manual specified in Section 16050.

1.4 QUALITY ASSURANCE

See Section 16050.

Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering disconnect switches and circuit breakers that may be incorporated into the work include the following:

1. General Electric Co.; Electrical Distribution and Control Division.
2. Siemens Energy & Automation, Inc.
3. Square D Co.
4. Eaton, Cutler Hammer.

2.2 DISCONNECT SWITCHES

A. MOTOR SAFETY DISCONNECT SWITCHES

Motor safety disconnect switches shall be provided when the motor starter is not in sight of the associated motor or when shown on the Plans. Motor safety disconnect switches shall be provided with the following specifications.

1. Separately Enclosed Knife Type Switches
 - a. Switches shall not be fused unless specifically shown otherwise on the Plans.
 - b. Switches shall include pad lockable handles, lockable in both the open and closed positions.
 - c. Switches shall be rated at 600 V.
 - d. Switches shall include two auxiliary contacts, rated at 10 A at 250 Vac each, connected to the switch pivot arm that are open when the switch is open, closed when the switch is closed.
 - e. Switches shall be rated at motor horsepower or as per the Plans, whichever is the larger.

f. Switch enclosures shall be NEMA 4X stainless steel unless specifically stated otherwise in the Plans or through the approval of the Engineer.

2. Switches Incorporated into a Field Control Panel

a. Three Phase Switches, 15 HP and Smaller.

Switches shall be 2-position, OFF-ON, 90 degree, 600 VAC, 20 A, 32 A, or 40 A rating, 4-pole, front door installation; Allen Bradley 194L-Eaa-1754 or equal,

where:

aa = 20 for motors less than 10 HP,

aa = 32 for a 10 hp, 460 VAC motor,

aa = 40 for a 15 hp, 460 VAC motor.

The 4th pole is reserved for switch position sensing.

Associated switch actuators shall be OFF-ON, 90 degree, front/door installation, IP66 rated, 22.5 mm central hole mount, square, grey/black handle with padlock provision, 64 mm x 64 mm; Allen Bradley 194L-HC6E-175I or equal.

b. Single Phase Switches.

Reference Specification 16940, Control Panels.

B. ENCLOSED, FUSIBLE SWITCH, 800 A AND SMALLER

1. NEMA KS 1, Type HD, Class R rejection fuse clips, enclosure consistent with environment where located, handle lockable with two padlocks, and interlocked with cover in CLOSED position.
2. Switches shall be horsepower rated when used in motor circuits.
3. Switches shall include pad lockable handles, lockable in both the open and closed positions.
4. Switches shall be rated at 600 V.
5. Switches shall include two auxiliary contacts, rated at 10 A at 250 Vac each, connected to the switch pivot arm that are open when the switch is open, closed when the switch is closed.

6. Switch enclosures shall be NEMA 4X stainless steel unless specifically stated otherwise in the Plans or through the approval of the Engineer.

2.3 DISCONNECT PLUGS

A. MOTOR DISCONNECT PLUGS AND RECEPTACLES

Motor safety disconnect plug and receptacle shall be provided as shown on the Plans and shall be provided to the following specifications:

1. Plugs and receptacles shall be motor rated and UL 2682 listed.
2. Plugs and receptacles shall have an integral mechanism to ensure the load is broken before the plug can be removed.
3. Plugs and receptacles shall be rated at 600 V.
4. Receptacles shall have a dead front construction.
5. Plugs and receptacles must be able to close at least once on a conditional short-circuit current of 65,000 amps.
6. Plug and receptacle wire terminals shall be spring assisted to prevent loosening due to conductor yielding, shocks, vibrations, or thermal cycling.
7. Plug and receptacle shall be able to withstand ambient temperatures between -40 degrees C to +60 degrees C.

2.4 ENCLOSED CIRCUIT BREAKERS

A. ENCLOSED, MOLDED-CASE CIRCUIT BREAKER

NEMA AB 1, with lockable handle in both the open and closed positions.

B. CHARACTERISTICS

Frame size, trip rating, number of poles, and auxiliary devices as indicated on the Plans with interrupting rating to meet available fault current.

1. Main and feeder breakers shall be molded case breakers with thermal magnetic trip.

2. Motor circuit breakers shall be magnetic only trip with adjustable trip setting.
3. Branch circuit breakers shall be molded case, thermal-magnetic trip, trip-free with non-interchangeable, non-adjustable trip unless otherwise noted.

C. APPLICATION LISTING

Appropriate for application, including switching fluorescent lighting loads (SWD) or heating, air-conditioning, and refrigerating equipment (HACR).

D. CIRCUIT BREAKERS, 200 A AND LARGER

1. Trip units shall be interchangeable within frame size.
2. Assure ability to selectively coordinate circuit breakers.

E. CIRCUIT BREAKERS, 400 A AND LARGER

Where indicated on the Plans, provide trip units with separate field-adjustable settings of instantaneous trip, short-time trip, short-time delay, long-time trip, and long-time delay.

F. CIRCUIT BREAKERS, 1000 A AND LARGER

Provide breakers with field-adjustable ground fault pickup.

G. MOLDED-CASE SWITCH

Where indicated, molded-case circuit breaker without trip units.

H. LUGS

Mechanical lugs and power-distribution connectors suitable for copper conductors of the number and size indicated.

I. SHUNT TRIP

Where indicated.

J. ACCESSORIES

As indicated.

NEMA AB 1, Type 4X stainless steel unless stated otherwise in the Plans.

K. TRAPPED-KEY INTERLOCKS

The service disconnect breaker and the generator disconnect breaker shall be protected by an OSHA-approved trapped-key interlock system, as described in section 16415. The breakers selected shall be compatible with all trapped-key interlock hardware described in section 16415 and the Plans.

2.5 ENCLOSED CIRCUIT BREAKERS

- A. Reference Specification 16050 for spare parts.

PART 3 EXECUTION

3.1 COORDINATION OF ELECTRICAL PROTECTION DEVICES

- A. The Contractor shall provide coordination of circuit breakers, fuses, and other associated protective devices.
1. For adjustable breakers, provide the values for continuous, short-time, instantaneous, ground fault, and other relevant trip and delay settings. Adjust breakers as per 3.4.
 2. Provide to the Owner and Engineer calculations, plots, and overlays that clearly show proper coordination of protection circuits.

3.2 INSTALLATION

- A. Install the disconnect switches and circuit breakers level and plumb in locations as indicated, according to manufacturer's written instructions.
- B. Install wiring between disconnect switches, circuit breakers, control, and indication devices.
- C. Connect disconnect 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.

- D. Identify each disconnect switch and circuit breaker according to requirements specified in Section 16050.

3.3 FIELD QUALITY CONTROL

A. TESTING

1. Prior to Energization

After installing disconnect switches and circuit breakers, perform visual and mechanical inspection of enclosure and devices.

Provide third party breaker testing per Specification 16050, Section 3.

Check connections and mounting for proper torque.

Remove any burrs, filings, or other foreign materials from enclosure. Completely wipe down and vacuum enclosure.

2. After Energization

After electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.4 ADJUSTING

Set field-adjustable disconnect switches and circuit-breaker trip ranges as indicated.

Provide fuses for fused disconnect switches to coordinate with manufacturer's listed maximum fuse size for equipment supplied by the disconnect switch.

***** END OF SECTION *****

SECTION 16415

TRANSFER SWITCHES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of the following types of power transfer switches:

- A. Automatic Transfer Switches.
- B. Manual Transfer Switches.
- C. Trapped-Key Interlocks.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01600	Materials and Equipment
01800	Testing, Commissioning, and Training
02300	Site Earthwork
Division 3	Concrete
09900	Painting
11000	Equipment General Provisions
Division 15	Mechanical
Division 16	Electrical
16120	Conductors and Cables
16130	Raceway and Boxes

1.3 DEFINITIONS

A. 2-POSITION

A 2-position ATS transfers immediately from one switch position to another. 2-position ATS can apply to both “Open Transition” and “Closed Transition” switches.

B. 3-POSITION, DELAYED TRANSFER

A 3-position “delayed transfer” ATS can be held in the “center” (no load connection) position for a programmable delayed period of time before completing its transfer to the calling position. Delayed transfer applies to

transfers in either direction. Delayed transfers can only apply to “Open Transition” switches.

C. AUTOMATIC TRANSFER SWITCH

Automatic transfer switches shall be defined as power transfer switches used to automatically switch system power away from faulty utility service power to backup generator power then back again to utility power when valid utility power is reacquired.

Automatic transfer switches can be configured for automatic generator starting, waiting for generator stability, then transferring the system bus to the generator. They are also configurable for switching back to utility power under selectable conditions.

Automatic transfer switches can be set up for automatic generator testing and shutdown.

D. CLOSED TRANSITION

A “Closed Transition” ATS provides a “make-before-break” transition when performing automatic generator tests. To make this type of transition, the voltage, frequency, and phase shift between the power sources must be within specified and programmable tolerances. Typical tolerances are $\delta V \leq \pm 5$ percent, $\delta f = \pm 0.2$ percent, and the phase shift between ± 5 electrical degrees. This may take from several seconds to several minutes and is only used during system testing where transition delays are not critical. During power failures, the transitions are “break-before-make” like an open-transfer switch where time delays are minimal.

E. DELAYED TRANSFER

A “Delayed Transfer” ATS provides a programmable delay in the “neutral position.” When in this mode, the load circuit is completely disconnected from both the normal and standby power sources. A delay in this position allows load circuits to dissipate electrical and mechanical energy before being re-energized.

F. KIRK® KEY

Trade name for a TRAPPED-KEY INTERLOCK.

G. NEUTRAL POSITION

The neutral position describes a position of the transfer switch when the load leads are connected to neither the normal nor the standby source. In this position, the load circuit is completely disconnected. This position should not be confused with the neutral bus or with neutral bus switching.

H. NON-AUTOMATIC TRANSFER SWITCH

Non-Automatic Transfer Switches are identical to ATS switches with the exception that they include a selector switch that allows manual transfer.

Non-Automatic Transfer Switches shall not be permitted.

I. MANUAL TRANSFER SWITCH

Manual transfer switches are double-throw switches with a center “OFF” position. Transfers are manually made by physically operating a switch handle to any one of three positions, “NORMAL,” “OFF,” “STANDBY.”

J. NEUTRAL SWITCHING

In a neutral-switching ATS, the neutral load bus is switched between power source neutrals in the same manner as the power leads.

K. NORMAL POSITION

A switch is in its “NORMAL” position when it is connected to the primary (utility) power source.

L. OPEN TRANSITION

An “Open Transition” ATS provides a “break-before-make” transition under all transition conditions.

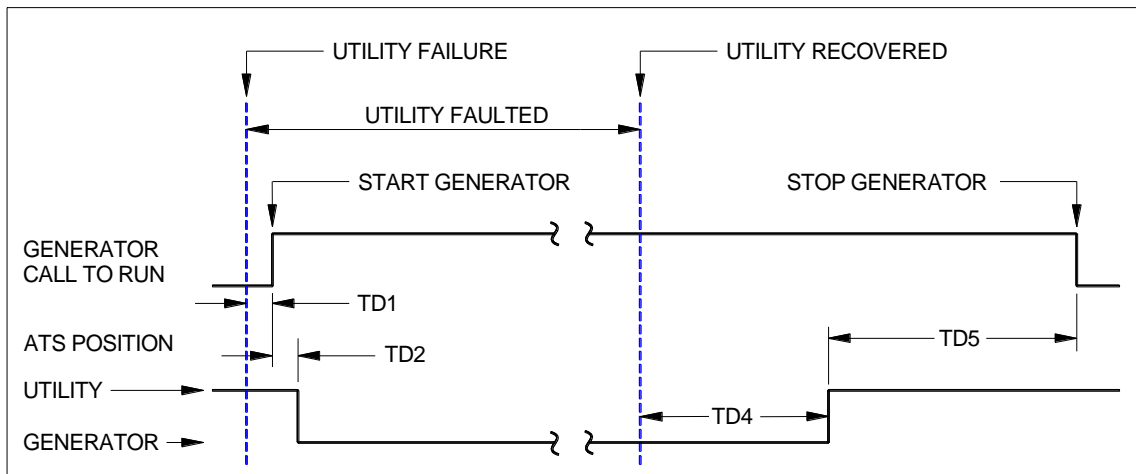
M. STANDBY POSITION

A switch is in its “STANDBY” position when it is connected to the secondary (generator) power source. This position may also be referred to as the back-up position.

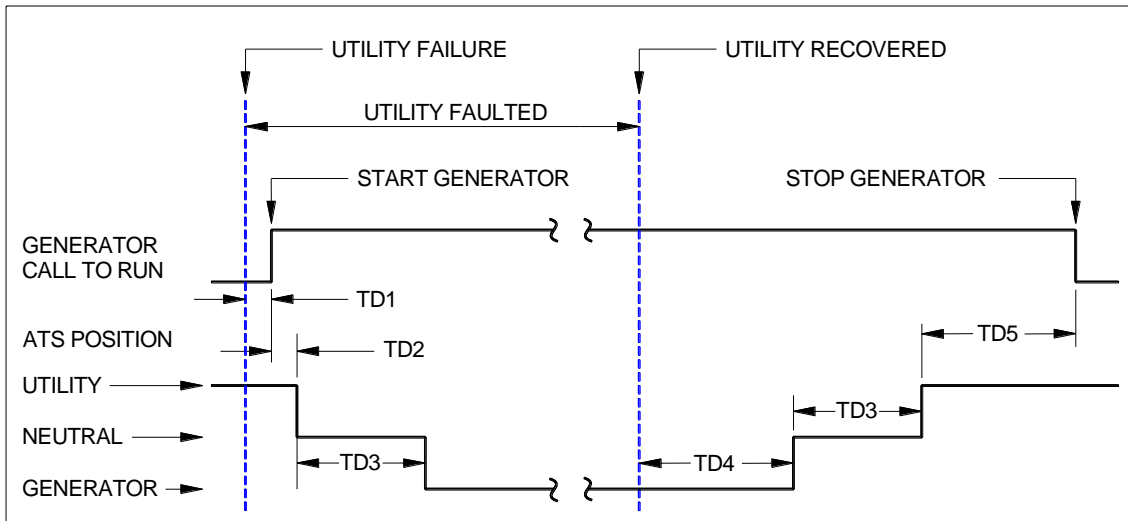
N. TIME DELAY DEFINITIONS

TD1 “Call Delay” is the delay from the ATS sensing faulty utility power and the issue of a generator call to run command.

- TD2 “Off Utility Delay” is the delay from the ATS issuing a generator call to run command and the transfer of the ATS away from the “UTILITY” position.
- TD3 “Hold Neutral Delay” is the period of time that the ATS will hold the switch in its “neutral” (or “center” or “disconnected”) position when transferring from the “UTILITY” position to the “GENERATOR” position and from the “GENERATOR” back to the “UTILITY” position. In this neutral position, the load side of the ATS is disconnected from both utility and generator power. This delay allows the electronic equipment ample time to dissipate their residual power for proper reapplication of power following a shutdown. This delay only applies to 3-position delayed-transfer switches.
- TD4 “Hold Generator Delay” is the delay of the ATS to switch back to utility power after the utility has been sensed as healthy.
- TD5 “Cool-Down Delay” is the duration of generator runtime after the ATS has switched back to utility. This cool down period is intended to shut the generator off only after a relaxed cooling period.



2-POSITION SWITCH SIMPLIFIED TIMING DIAGRAM



3-POSITION SWITCH SIMPLIFIED TIMING DIAGRAM

O. TRAPPED-KEY INTERLOCK

A system of mechanical locks that prevents the simultaneous closing of two or more switches. A common configuration features two breakers with a single key, such that only one breaker may be unlocked and closed at any time.

Also known by trade name “Kirk® Key.”

P. UVTL

Utility Voltage Transition Level.

Q. GVTL

Generator Voltage Transition Level.

1.4 SUBMITTALS

Submit four copies of the following:

- A. Manufacturer’s Product Data for transfer switches and accessories specified in this Section.
- B. Manufacturer’s Product Data for trapped-key interlocks and accessories specified in this Section, and documentation of compatibility with hardware specified under other Sections.

- C. O&M Manual requirements are outlined in Section 01300 and shall also contain the following information:
1. Two-year maintenance service agreement as described below.
 2. Screenshots and descriptions detailing how to step through the setup and configuration menus.
 3. Field test results as described herein.
 4. For trapped-key interlocks, provide manufacturer's user manual, contact information for the manufacturer, part numbers for replacement keys and lock cylinders, and any additional codes needed to replace key and locks used in the system.

1.5 MAINTENANCE

A. ATS

Beginning at the time of Substantial Completion, provide a 24 months full maintenance service performed by skilled employees of the manufacturer's designated service organization. Provide OEM parts and supplies to complete all service to support all factory warranty requirements with written reports to the Owner upon completion of visits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Subject to compliance with requirements, provide products by the following:

A. TRANSFER SWITCHES

All automatic transfer switches shall be compatible with the selected genset.

1. General Electric Co.; Electrical Distribution & Control Div.
2. Eaton, Cutler-Hammer.
3. ASCO
4. Kohler
5. Cummins Power Generation/Onan

6. Square D

7. MTU

B. TRAPPED-KEY INTERLOCKS

1. Halma, PLC (Kirk Key, Castell)

2. Rockwell Allen-Bradley

3. Or equal.

2.2 PROCUREMENT

A. The party responsible for the procurement of the automatic transfer switch shall be the single source of responsibility for submittal, products provided, warranty, startup and service purposes.

B. All automatic transfer switches shall be provided by the contractor that is supplying the generator set as defined in Specification 16230.

Exceptions:

- *An automatic transfer switch that is to be mounted inside a UL508 fabricated enclosure shall be provided by the fab shop. The fab shop shall assure that the automatic transfer switch does not increase the size of the fabricated enclosure as shown in the Plans. Automatic transfer switches inside fabricated enclosures shall be provided within their own manufacturer's enclosures – there shall be no electrical components exposed within the fabricated enclosure.*

- *An automatic transfer switch that is to be mounted inside a Motor Control Center (MCC) shall be provided by the MCC manufacturer.*

C. The generator and automatic transfer switches may be of different manufacturers.

D. All trapped-key interlocks shall be provided as a complete package from a single vendor, including locking devices, lock cylinders, and keys.

2.3 AUTOMATIC TRANSFER SWITCHES

A. RATINGS

1. Phases: As shown on the Plans.
2. Poles: As shown on the Plans.
3. Voltage Rating: As shown on the Plans.
4. Current Rating: As shown on the Plans.
5. Fault Current Rating: As shown on the Plans.
6. Neutral: With neutral bus unless indicated otherwise on the Plans.
7. Enclosure: As shown on the Plans.

B. FEATURES

Reference “DEFINITIONS” in this specification.

1. UL 1008/CSA certification.
2. Open Transition

Delayed transfer (3-position) switch, capable of transferring the connected load from its “normal” power source to a “neutral” (disconnected) position for a programmable period of time, then from the “neutral” position to its “standby” power source, and capable of retransferring back to its "normal" power source with mirrored positions and delays.

Delay settings:

Setting	Timing Function⁽¹⁾	Initial Duration
TD1	Call Delay	1 second
TD2	Off Utility Delay	0 seconds
TD3	Hold Neutral Delay	30 seconds
TD4	Hold Generator Delay	30 minutes
TD5	Cool-Down Delay	5 minutes

(1) Reference “Time Delay Definitions”

3. Power switching shall be provided for all phases.
4. Power sensing shall be provided for all phases.
5. Switch transfer control sensing shall be provided on all phases.
6. Switching mechanism shall be a discrete purpose device specifically designed for Automatic Transfer Switches.
7. Electrically operated by solenoid mechanisms and held by mechanical latches.
8. High current-breaking capacity with silver-surfaced contacts equipped with arc barriers and magnetic blow-out coils.
9. Contacts rated in accordance with UL 1008 for current carrying and switching capabilities.
10. Suitable for repetitive load transfer switching. Minimum 1,000 transfer cycles under full load conditions and minimum 2,000 cycles under no load conditions.
11. Interlocked to prevent supplying the load from more than one source at a time.
12. Adjustable close differential voltage monitoring relays provided on all three phases to sense voltage on the “NORMAL” and “STANDBY” sources.
13. Auxiliary Contacts
 - a. All auxiliary contacts shall be isolated, dry, Form C, suitable for 120V, 10A inductive loads, NEMA B10 rated, wired to easily-accessible terminals in the low voltage control area.
 - b. Provide, as a minimum, the following status outputs:
 - i. Switch in utility power position.
 - ii. Switch in generator position.
 - iii. Switch fault.

- iv. Generator call status. This status signal is one of two identical outputs. One can be directly connected to the generator to call a start operation. The second is electrically isolated from the generator connection and intended for connection to monitoring equipment.
14. Molded case breakers are not acceptable.
15. Intelligent display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. The display panel shall be capable of providing the following functions and capabilities:
- a. Display source condition information, including AC voltage for each phase of normal source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance. Line to neutral voltages shall be displayed for 4-wire systems.
 - b. Display source status, to indicate source is connected or not connected.
 - c. Display load data, including 3-phase AC voltage, 3-phase, frequency, kW, and kVA.
 - d. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:
 - i. Set nominal voltage and frequency for the transfer switch.
 - ii. Adjust voltage and frequency sensor operation set points.
 - iii. Set up time clock functions.
 - iv. Set up load sequence functions.
 - v. Enable or disable control functions in the transfer switch, including program transition.

- vi. Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.
- e. Display real time clock data, including date, and time in hours, minutes, and seconds. The real time clock shall incorporate provisions for automatic daylight saving time and leap year adjustments. The control shall also log total operating hours for the control system.
- f. Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.
- g. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, and network communications error.

C. OPERATION

- 1. When “normal” voltage falls below invalid UVTL, then
 - a. The ATS starts the generator.
- 2. When the “standby” voltage is above valid GVTL, then
 - a. After a programmable delay in the “normal” position, the switch transfers from the “normal” position to the “neutral” position.
 - b. After a programmable delay in the “neutral” position, the switch transfers from the “neutral” position to the “standby” position.
- 3. When “normal” voltage is above valid UVTL, then
 - a. After a programmable delay in the “standby” position, the switch transfers from the “standby” position to the “neutral” position.

- b. After a programmable delay in the “neutral” position, the switch transfers from the “neutral” position to the “normal” position.
 - c. After the switch returns to the “normal” position, the transfer switch shuts off the generator after a programmable cool down delay.
- 4. Two separately adjustable time delays prevent transfer and retransfer on voltage dips.
- 5. Seven-day exercise timer provides periodic exercising of generator.
 - a. Timer is programmable as to day of week, time of day, and duration for exercising.
 - b. Programmable as to whether generator is exercised with or without load being transferred
- 6. Initially preset the UVTL at:
 - a. Valid \geq 90 percent nominal system voltage
 - b. Invalid \leq 80 percent nominal system voltage
 - c. Relay will pull in at the “valid” level and drop out at the “invalid” level.
- 7. Initially preset the GVTL at:
 - a. Valid \geq 90 percent nominal system voltage
 - b. Invalid \leq 75 percent nominal system voltage
 - c. Relay will pull in at the “valid” level and drop out at the “invalid” level.
- 8. Initially preset the utility and generator frequency transition levels at:
 - a. Valid \geq 95 percent of system frequency
 - b. Invalid \geq 90 percent of system frequency

9. Enclosure

a. Mounted Inside a Closed Room

NEMA 12 unless indicated otherwise on the Plans.

b. Not Mounted Inside a Closed Room

NEMA 4X stainless steel unless indicated otherwise on the Plans.

D. FEATURES

1. UL 508, UL 98 certification and in accordance with article 702 of the NEC, ANSI/NFPA 70.

2. Switches shall include pad lockable handles, lockable in the “NORMAL,” “OFF,” and “STANDBY” positions.

3. Switches shall include two auxiliary contacts:

a. One contact closed when in “NORMAL” position.

b. The other contact closed when in “STANDBY” position.

c. Both contacts open in “OFF” position.

Both contacts shall be rated at 10 A, 250 V.

4. Capable of transferring the connected load from “NORMAL” to “OFF,” from “OFF” to “STANDBY,” from “STANDBY” to “OFF,” and from “OFF” to “NORMAL.”

5. Manual mechanical switch movement.

E. OPERATION

1. Transfers from “NORMAL” to “OFF” on manual movement of switch handle.

2. Transfers from “OFF” to “STANDBY” on manual movement of switch handle.

3. Transfers from “STANDBY” to “OFF” on manual movement of switch handle.

4. Transfers from “OFF” to “NORMAL” on manual movement of switch handle.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

Deliver transfer switch components to their final locations in protective wrappings, containers, and other means of protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards. Field repair of material or equipment made defective by improper storage or site construction damage by other trades may be cause for rejection of installation.

3.2 INSTALLATION

- A. Install transfer switch per the manufacturer’s installation instructions.
- B. Maintain minimum workspace around unit and components per manufacturer’s installation shop drawings and NFPA 70 NEC.

3.3 IDENTIFICATION

Identify field-installed wiring, components, and provide warning signs as specified in Section 16050.

3.4 GROUNDING

Provide ground continuity to facility electrical ground system as indicated in the Contract Provisions.

3.5 FIELD QUALITY CONTROL

A. ADJUSTING AND PRETESTING

Pretest all system functions, operations, and protective features. Provide all instruments and equipment required for testing. Adjust the time delays, and trip point settings to ensure operation is within accordance to the specifications.

B. FIELD TEST

Test the transfer switch after installation is complete.

1. Advise the Engineer of the test date well in advance so that the test may be witnessed if desired.
2. Perform manufacturer's standard field tests.
3. Provide documented field test results to Owner and Engineer.
4. Provide trip set points and time delays in the O&M manual.

***** END OF SECTION *****

SECTION 16420

MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes AC motor controllers rated 600 volts and less that are supplied as enclosed units within motor control centers or as individual units mounted in equipment specified under other sections.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Items</u>
13451	Programmable Logic Controller (PLC) Programming
13452	HMI Programming
16050	Basic Electrical Materials and Methods
16120	Conductors and Cables
16410	Enclosed Switches, Fuses, and Circuit Breakers
16442	Motor Control Equipment
16910	PLC Hardware and Software Procurement
16940	Control Panels

1.3 DEFINITIONS

A. ANALOG AMMETER

A dial-type, d'Arsonval movement, analog meter measuring motor ampacity, either directly or indirectly from a current transformer connected to one of the motor leads.

B. COMPLETE COMBINATION STARTER

The terms STARTER, MOTOR STARTER, COMBINATION MOTOR STARTER, and COMBINATION STARTER are all equivalent to COMPLETE COMBINATION STARTER as described here.

A Complete Combination Starter consists of all power, control, and communication devices required to completely and safely operate a motor in HAND control. It consists of a lockable Overcurrent Protective Device (OCPD) such as a circuit breaker or a fused disconnect, a Power Module (RVSS, VFD, or Magnetic) for controlling/applying power to the motor, Motor Overload Protection (MOP) circuits, and other ancillary circuits for complete control and protection of the motor and starter power devices. It

includes an enclosure with operator interface control and monitoring devices.

C. FST (FIELD SERVICE TECHNICIAN)

A Field Service Technician (FST) is defined as a “hands-on” field representative qualified and authorized to perform technical start-up and trouble-shooting work on the manufacturer’s motor starters including drive programming and configuration.

D. FVNR BYPASS CONTACTOR

In RVSS starter power circuits, an FVNR rated BYPASS CONTACTOR is one whose current rating is sufficiently high to allow direct across-the-line motor starting in an FVNR mode (RVSS failure).

See RUN RATED BYPASS CONTACTOR in this section.

In VFD starter power circuits, the function of the FVNR BYPASS CONTACTOR is to provide across-the-line motor control in the event that the VFD fails. This CONTACTOR must have a current rating that is sufficiently high to allow direct across-the-line motor starting in an FVNR operating mode (VFD failure).

E. FVNR (FULL VOLTAGE NON-REVERSING) STARTER

FVNR starters operate motors in only one direction. These starters instantly apply full line voltage to the motor terminals through a contactor relay.

See MAGNETIC STARTER.

F. FVR (FULL VOLTAGE REVERSING) STARTER

FVR starters operate motors in both forward and reverse directions. These starters instantly apply full line voltage to the motor terminals through two separate (one forward and one reverse) contactor relays.

See MAGNETIC STARTER.

G. HIM (HUMAN INTERFACE MODULE)

HIM units are programmable human interfaces to RVSS and VFD drives and are used to configure the drive protection and control options. These

devices are typically provided with programming/operating buttons and visual displays.

H. IGBT (Insulated Gate Bipolar Transistors)

IGBTs are embedded devices used to provide power switching in the DC-to-AC inverter section of VFD power modules.

I. MAGNETIC MOTOR STARTER

Because FVNR and FVR starters use an electromagnetic contactor relay to transfer power to the motor, these devices are a part of the MAGNETIC STARTER family of motor starters.

See FVNR, FVR.

J. POINT OF ANALYSIS

The Point of Analysis is a point indicated on the electrical one-line diagram(s) where the contractor is responsible to comply with the Total Harmonic Current Distortion (THDC) limits of the IEEE-519, 2014 standard. By defining this point, the Engineer is providing all manufacturers a common point to calculate their THDC values.

The “available short circuit current” (I_{SC}) value required for IEEE-519 calculation shall be taken from the electrical one-line diagram(s) of the Plans as the BOLTED FAULT CURRENT at the Point of Analysis.

The “average maximum demand current” (I_L) value required for IEEE-519 calculation shall be taken from the UTILITY LOAD DEMAND column of the LOAD SUMMARY table on the electrical one-line diagram(s) of the Plans. Only loads “downstream” of the Point of Analysis shall be utilized in the calculation of I_L .

K. RAMP RATE, RVSS

The RVSS ramp rate is defined as the time, in seconds, for the RVSS to increase motor speed from zero to full speed or decrease motor speed from full speed to zero.

L. RAMP RATE, VFD

The VFD ramp rate is defined as the time, in seconds, for the VFD to increase its output frequency from 0 Hz to 60 Hz or decrease its output frequency from 60 Hz to 0 Hz.

M. RUN-RATED BYPASS CONTACTOR

In RVSS starter power circuits, a run rated BYPASS CONTACTOR is one whose current rating is limited to the RVSS current rating. This type of bypass contactor cannot be used to directly start the motor across-the-line.

See FVNR BYPASS CONTACTOR in this section.

N. RVSS (REDUCED VOLTAGE, SOFT START)

The RVSS is the manufacturer's integrated power module package without additional starter components, and consists of embedded electronic power switching devices for acceleration and deceleration, associated "firing" control circuitry, and an embedded microprocessor for power circuit firing control and motor/module protection. It is one of the key components that make up a COMPLETE COMBINATION RVSS STARTER.

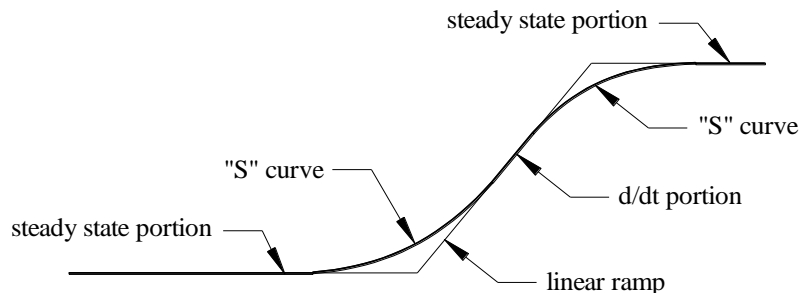
The RVSS power module may or may not include a RUN-RATED BYPASS CONTACTOR.

O. SCRS (SILICON CONTROLLED RECTIFIERS)

SCRs are GE's trade name for a thyristor (a four-layer unidirectional switching device). SCRs are triggered by the application of a gate current and are shut off at a zero-voltage crossover.

P. "S" CURVES

A modified linear-ramp curve with rounded edges between portions of the curve that are changing (d/dt portions) and portions of the curve that are not changing (steady state).



Q. THD (TOTAL HARMONIC DISTORTION)

THD is defined as the ratio of the sum of the levels of all harmonic components to the level of the fundamental frequency.

Values are limited by the IEEE 519, 1992 standard developed to minimize power problems related to non-linear loads, such as VFDs.

R. VFD

The VFD is the manufacturer's integrated power module package without additional starter components, and consists of an embedded AC-to-DC converter, a DC link, and a DC-to-AC inverter, associated inverter "firing" control circuitry, and a microprocessor for power circuit firing control and motor/module protection. It is one of the key components that make up a COMPLETE COMBINATION VFD STARTER.

1.4 SUBMITTALS

Do not submit motor starters under a separate 16420 submittal. Submit motor starters under the MCC submittal, 16442.

Submit under the provisions of Section 01300.

Submit a complete Bill of Materials (BOM) for each motor starter.

Submit drawings showing schematics for each motor starter. Schematics shall include all physical devices and connections of power and control circuits. Schematics shall include diagrams or descriptions clearly describing internal VFD logic where applicable. All devices on the schematics shall be tagged with their associated BOM number.

Submit drawings of door-mounted devices with associated BOM numbers.

Submit the name and phone number of the technical person that will be made available to the Engineer/Integrator for support of internal drive programming and configuration.

Submit Manufacturer's product data for motor controllers and accessories specified in this Section.

Submit maintenance data for tripping devices to include in the operation and maintenance manual specified in Section 16050.

Submit compiled load current and overload relay list after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.5 QUALITY ASSURANCE

See Section 16050.

1.6 COORDINATION

The Contractor shall acquire the full and complete nameplate data for each motor and document this data for insertion into the O&M Manual. This data shall be made available during FIELD TESTING AND COMMISSIONING work as described in Section 3.5.

Coordinate the sizing and settings of each starter's Overcurrent Protective Device (OCPD) and Motor Overload Protection (MOP) device with associated motor's nameplate data.

1.7 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include the following:

1. Allen-Bradley Co.; Industrial Control Group.
2. Eaton Corp.; Westinghouse & Cutler-Hammer Products.
3. Square-D.

When motor starters are integrated into Motor Control Centers (MCCs), the starters shall be fabricated, tested, and UL labeled by the MCC manufacturer.

2.2 PRODUCT SHIPMENT AND STORAGE

A. PRODUCT SHIPMENT

The motor starters shall be delivered to the project's System Integrator (reference specification 16940) for temporary connection and integrated testing with the site PLC prior to being delivered to the jobsite. This testing will be coordinated by the System Integrator and combined into a complete witness test of both the PLC and motor starter controls. All hardwire connections between the PLC(s) and the motor starters shall be tested during the witness test. For the test, all motor starters (whether FVNR, FVR, RVSS, or VFD) shall be powered at their full operational voltage and shall be connected and tested against a voltage-rated AC squirrel cage motor. Allow for the Owner and Engineer to witness these tests. Provide a minimum of 15 days' notice prior to the test.

The System Integrator shall be responsible for repackaging and shipping to the jobsite. The Contractor is responsible for unloading the shipment.

B. PRODUCT STORAGE

Motor starters, whether in MCCs or stand alone, shall be packaged, covered, and protected from weather and physical damage during storage before final installation.

2.3 COMBINATION MOTOR STARTERS, GENERAL

A. ENCLOSURES

1. For Starters Internal to MCCs

For starters internal to MCCs, reference Section 16442 (Control Centers) and reference the MCC NEMA rating(s) on the Plans.

B. COMPLIANCE

1. Standards

Motor starters shall be Underwriter's Laboratory (UL) listed and labeled, and comply with the latest applicable standards of ANSI, IEEE, and the National Electrical Code.

C. GENERAL DEVICES AND COMPONENTS

All combination motor starters shall include the following devices:

1. Overcurrent Protective Device (OCPD).
 - a. The OCPD shall be a UL 489 motor circuit breaker protector, magnetic only, with field-adjustable short-circuit trip-coordinated with motor locked-rotor amperes for the specific motor being powered.
 - b. The OCPD shall be lockable in the OPEN position and shall include an auxiliary Form A contact that is open when the OCPD is electrically tripped or manually opened.
 - c. The OCPD shall be lockable from the front panel, without the operator having to open the panel door.
 - d. The OCPD shall be sized by the motor controller manufacturer for the motor being served and shall be selectively coordinated with OCPDs upstream as per Section 16410.
2. Control Devices (reference Specification 16940)

The following minimum requirements apply:

- a. Provide surge protective devices across each AC and DC relay coil.
- b. Provide control and timing relays per Section 16940.
- c. Provide LED “push-to-test” indicating lights.
- d. Provide combination electromechanical motor start counter and motor run time (elapsed time) meters per Section 16940. Battery backed LCD displays will not be accepted.
- e. Provide Phase Monitor Relays that monitor phase loss, phase imbalance, phase reversal, under-voltage, and over-voltage, with a Form A contact that is active on any of these conditions.

Exception:

- *Programmable starters that provide the Phase Monitor Relay functions as described above do not require an additional discrete phase monitor relay.*

f. Door-Mounted Devices

Provide door-mounted devices as specifically shown on the Plans.

Door-mounted devices, such as elapsed time meters, motor start counters, indicating lights, ammeters, selector switches, reset pushbuttons, etc., shall not be replaced with electronic panel functions.

g. Devices Mounted Internal to the Enclosure

Motor starters shall include all components and devices necessary to provide the electrical control functionality shown on the Motor Starter Elementary Wiring Diagrams on the Plans.

Electromechanical relays and timers shall not be replaced with electronic logic functions.

Exception to 2:

- *Unless specifically approved by the Engineer.*

3. Control Circuit Requirements

- a. Control functions shall match those shown on the Motor Starter Elementary Diagrams including manual requirements by the operators.

Provide additional circuits and devices as required by the starter manufacturer for power circuit isolation; however, these additions shall not change the features or functionality of the intended design.

- b. Provide additional fusing or device protection as required to protect the drive's electronic power and control circuits and to comply with UL requirements.

- c. Motor starters shall be provided with independent fused “control power” circuits. A fault in one motor control circuit shall only disable that associated motor.
 - i. Motor starter control circuits shall be 120 volts AC.
 - ii. If motor power is derived from voltage configurations that directly provide 120 volts AC line-to-neutral (240/120 volts AC or 208/120 volts AC systems), then each control circuit shall be provided with an individual fuse protective device at 120 volts AC.

NOTE:

Motor starters operating from a 240/120 Vac, 3-phase power source shall be provided with an internal label as shown here:

<p>CAUTION: B PHASE HAS 208 VOLTS TO GROUND</p>

Motor starters operating from a 240/120 Vac, 3-phase power source shall not have their motor starter control power be derived from Phase B and neutral.

- iii. If motor power is derived from 480 Vac, then each control circuit shall be provided with an independent control transformer with a 120-volt AC fused secondary. The fuse shall be factory mounted to the top of the transformer.
- iv. Motor starter control circuits may include remote panel heaters, motorized dampers, blower enclosure cooling fans, or other small power devices. Size the control transformers and fuses to handle all connected loads shown on the Plans plus an additional 25 percent.

D. SPECIAL POWER CIRCUITS

Some motor starters require “special power circuits” as listed below. These circuits are not included in the G&O Motor Elementary Wiring Diagrams. If required, the manufacturer shall provide the power

contactors and control circuits. Special Power Circuits include the following functions and are applicable to motor starter types as listed below:

Function	VFD	RVSS	FVNR
Line Filter Switching	X		
Isolation Contactor	X	X	
Bypass Contactor, Start-Rated (FVNR)	X	X	
Bypass Contactor, Run-Rated		X	
Power Factor Caps		X	X

These functions shall be provided as described on the Plans and within these Specifications.

E. WORK BY MANUFACTURER

1. All starters

- a. The manufacturer shall provide motor controls as defined in these specifications and as shown on the Motor Starter Wiring Diagrams in the Plans.
- b. The manufacturer shall provide complete combination motor starters as described in this section of this specification.
- c. The manufacturer shall provide all physical (external) control relays and timers per Motor Starter Wiring Diagrams in the Plans. These devices shall not be integrated into programmable starter devices (VFDs, RVSSs, Smart Overload Relays, Extended I/O, etc.).
- d. The manufacturer shall provide additional internal controls and external relays/contactors for “special power circuits” as required for drive protection and manufacturer’s warranty.

2. Starters with Programmable Devices

Motor starters containing programmable devices (VFDs, RVSSs, Smart Overload Relays, Extended I/O modules, etc.) shall be configured as follows:

- a. The manufacturer shall provide internal fault logic for protection of motors and starter power devices. These are

the manufacturer's programmed conditions as required to warrant the system. A relay "FAULT" output will be programmed true on these fault conditions.

- b. The manufacturer shall provide HIM programming as follows:
 - i. HIM Display:
 - (1) The HIM will always display the "fault code" if faulted.
 - (2) If not faulted, then the HIM will display motor speed or motor amps (owner selection).
 - ii. HIM Key Pad:
 - (1) The system can be placed in the PROGRAMMING mode only through password entry. The password shall be provided to the owner.
 - (2) START, STOP, RESET, HAND, OFF, AUTO keys are inactive (locked out) unless in the programming mode.

3. Networked Starters.

- a. For VFD motor starters the manufacturer shall provide internal logic for control of "RUN", "SPEED REFERENCE", and "PUMP SET OK" functionality per the Motor Starter Wiring Diagrams in the Plans. If different pin assignments are used by the manufacturer, then these shall match the external and internal logic connections as shown in the plans and shall be clearly documented during submittal. Extended I/O modules (EIOMs) shall be added as required to meet these conditions.

For non-VFD motor starters, the manufacturer shall provide internal logic for control of "RUN" and "PUMP SET OK" functionality per the Motor Starter Wiring Diagrams in the Plans. If different pin assignments are used by the manufacturer, then these shall match the external and

internal logic connections as shown in the plans and shall be clearly documented during submittal. Extended I/O modules (EIOMs) shall be added as required to meet these conditions.

- b. The manufacturer shall configure and program the internal logic functions and HIM unit, as described in these specifications and on the Plans.
- c. The manufacturer shall provide all drive digital inputs to be readable by the PLC over the network.
- d. The manufacturer shall provide full support to the PLC programmer for the acquisition and transfer of networked I/O.

F. WORK BY INTEGRATOR OR FST

1. General

The manufacturer shall allow for field adjustments by a qualified FST and shall support the efforts of the FST during the panel shop witness testing and during startup and commissioning as defined in this specification. Reference Section 3.5.

The manufacturer shall provide the FST directly or authorize the FST work to be performed by the Integrator. If authorized to be performed by the Integrator, then

- a. Such adjustments and settings shall not affect the manufacturer's warranty or transfer the manufacturer's liability to the Integrator, and
- b. Such work by the Integrator shall be financially compensated for by the manufacturer.

2. Settings Specific to the Application:

The FST shall provide drive module configuration settings as listed below. These changes shall not affect the manufacturer's warranty or reduce the manufacturer's liability.

- a. Current limit settings,

- b. Motor protection settings,
- c. Final settings for the fixed maximum and minimum speeds,
- d. Providing frequency notch (avoidance) bands,
- e. Final settings for the fixed acceleration and deceleration ramp rates,
- f. Others with approval.

2.4 MAGNETIC MOTOR STARTERS

NEMA ICS 2, Class A, full voltage, reversing or non-reversing (FVR or FVNR respectively), across the line.

Reference section COMBINATION MOTOR STARTERS, GENERAL

A. THE POWER CIRCUIT

1. Overcurrent Protective Device (OCPD).

Reference GENERAL DEVICES AND COMPONENTS, Section 2.3C.

2. Magnetic Contactor.

The magnetic contactor shall be NEMA rated, Size 1 minimum. IEC contactors will not be permitted.

3. Motor Overload Protection (MOP).

- a. Bimetallic Overload Protection

Three overload elements of melting alloy or bimetal type selected to provide Class 10 protection for the actual motor furnished. Units are manual reset type with an external reset mechanism provided in the starter enclosure front and a minimum of one NO and one NC isolated dry contact rated at 1.5 amps at 240 volts AC minimum.

Exception to A:

- *Unless specifically shown otherwise on the Plans or unless specifically approved by the Engineer.*

B. THE CONTROL CIRCUIT

Reference GENERAL DEVICES AND COMPONENTS, Section 2.3C.

2.5 VFD MOTOR STARTERS

A. GENERAL

The drive is designed to provide variable speed control of a standard NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency. Output power is of suitable capacity and wave form to provide step-less speed control of the specified 3-phase motor throughout a continuous speed range under variable or constant load (as applicable) not exceeding the motor's full load rating.

Controller is suitable for and coordinated with the thermal, electrical, and mechanical characteristics of the motor actually furnished to which it is connected.

Coordinate the drive capability with the torque characteristics (variable or constant torque) of the actual equipment furnished, which is driven by the motor to which the drive is connected.

B. THD NOISE IMMUNITY AND COMPLIANCE WITH IEEE 519

1. THD levels shall meet the recommendations of IEEE-519, 2014 at the "Point of Analysis" (reference definitions). Reference to the location of values for I_{SC} and I_L required for IEEE-519 calculations are described in the definition.
2. During submittal, show the values and calculations used to determine the level and type of line filters being submitted and their assumed compliance with IEEE-519.

C. THE POWER CIRCUIT

1. Technology
 - a. The Bridge

Power switching devices shall be IGBTs.

VFD motor starters shall be six-pulse, Pulse Width Modulated (PWM).

b. Control Type

Variable Torque Output Rating:

Three-phase, 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.

2. Overcurrent Protective Device (OCPD)

Reference GENERAL DEVICES AND COMPONENTS, Section 2.3C.

3. The VFD

- a. Capable of sustaining 115 percent of motor rated full load current indefinitely.
- b. Operates in an ambient temperature of 0 to 40 degrees C.
- c. Maintains displacement power factor of 0.95 or better over the entire speed range.

4. Motor/Drive Protection, Adjustments, and Auto Reset

- a. VFD shall include self-diagnostics for detection of failed circuitry.
- b. Fault detection shall shut down motor operation as shown on the Plans. Upon removal of fault condition, the drive shall automatically reset and attempt to restart.
- c. Upon return of power after an outage, the drive shall automatically restart.
- d. In addition to other specified standard protective functions the VFD shall provide the following:
 - i. Drive over-temperature trip.
 - ii. Short-circuit protection.
 - iii. Fault current protection of AC to DC rectifier section.

- iv. Adjustable current limit of 50 to 110 percent of full-load rating.
- v. Stall prevention.
- vi. Surge protection from input line AC transients (lightning/surge arrester).
- vii. Electrical isolation between power and logic circuits.
- viii. Able to withstand output terminal line-to-line short circuits without component failure.

5. Line and Load Circuit Conditioning

a. Line Filtering

Passive line filtering shall be provided on all VFD starters to assist in compliance to IEEE 519-2014. Line filters may consist of reactors only or may include capacitors and resistors as required to comply with IEEE 519-2014. The minimum line filter shall consist of a 3 percent reactor.

Line filters that include capacitors shall have the capacitors switched off when the motor is not running.

Circuits internal and external to the drive module required to control the application of the capacitors shall be provided by the manufacturer. Extended I/O modules (EIOMs) shall be added as required to meet this requirement.

Line filters may be a separate device or integral to the drive module.

b. Load Filtering

Passive load filtering shall be provided on all VFD starters to reduce motor winding voltage stress, improve drive stability, and assist in drive protection. The filter shall consist of a simple reactor or a passive combination RLC dv/dt filter as described below.

- i. For motor lead lengths less than 200 feet
Provide 1.5 percent load reactor.
- ii. For motor lead lengths greater than 200 feet
Provide an RLC dv/dt load filter with a 1.5 percent load reactor.

Exception to 5:

- *Line filtering may not be required when using 18-pulse technology or active filters. Requirements to be defined by the manufacturer for compliance to IEEE 519-1992.*

6. VFD Isolation

Circuits internal and external to the drive module required to control the isolation of the VFD module shall be provided by the manufacturer. Extended I/O modules (EIOMs) shall be added as required to meet this requirement.

D. THE CONTROL CIRCUIT

Reference GENERAL DEVICES AND COMPONENTS, Section 2.3C.

E. VFD SPEED CONTROL

VFD motor starters shall be provided with manual and automatic speed control. Automatic speed control may be derived from a signal source remote from the starter and may be hardwired, networked, or both for redundancy.

1. Manual Speed Control

Manual speed control shall be selected by the VFD as shown in the Motor Starter Wiring Diagrams in the Plans.

The Manual Speed Reference shall be derived from the drive's Human Interface Module (HIM). Regardless of the manual range setting, the speed shall be limited to values between "minimum speed" and "maximum speed" programmed in the VFD through the HIM.

2. Hardwired Speed Reference

Remote hardwired speed references shall be from an isolated 4-20 mA analog signal. Four mA shall equate to 0 Hz (0 percent speed). Twenty mA shall equate to 60 Hz (100 percent speed). Regardless of the 4-20 mA signal, the speed shall be limited to values between “minimum speed” and “maximum speed” programmed in the VFD through the HIM.

3. Networked Speed Reference

Remote networked speed references shall be transferred over a LAN between the controlling PLC and VFD drive. The range shall be between 0 and 100 percent, where 0 percent shall equate to 0 Hz (0 percent speed) and 100 percent shall equate to 60 Hz (100 percent speed). Regardless of the minimum speed reference sent over the LAN, the speed shall be limited to values between “minimum speed” and “maximum speed” programmed in the VFD through the HIM.

F. VFD DRIVE CONTROL

1. Microprocessor based digital logic control programmable from the HIM.

2. Speed Control

- a. Maximum speed is field adjustable up to the rated 60 Hz motor speed.
- b. Minimum speed is field adjustable from 0 to 75 percent of maximum rpm.
- c. The minimum and maximum speeds are independently field adjustable through the HIM. Initial settings shall be preconfigured by the starter manufacturer for each VFD starter as shown in the table below.
- d. Speeds shall increase and decrease at a linear ramp rate, independently adjustable for acceleration and deceleration through the HIM. Initial settings shall be preconfigured by the starter manufacturer for each VFD starter as shown in the table below.

Tag Number	Description	Ramp Rates (0-100% speed) in sec.		Speed Limits (in % full speed)	
		Accel.	Decel.	Min.	Max.
[01 MTR 02]	MOTOR, EXHAUST FAN	5	5	40	100
[02 MTR 02]	MOTOR, EXHAUST FAN	5	5	40	100
[03 MTR 04]	MOTOR, MECHANICAL ROOM, NO. 1 EXHAUST FAN	2	5	55	100
[03 MTR 05]	MOTOR, MECHANICAL ROOM, NO. 2 EXHAUST FAN	2	5	55	100

3. In addition to other specified features, provide the following:
 - a. Low-frequency voltage boost.
 - b. Coast to rest/stop.
 - c. Minimum five-cycle logic power carryover during utility loss.
 - d. Insensitivity to line rotation.
 - e. Display of fault information.
 - f. Slip compensation.
 - g. Programmable “jump frequency.”

G. VFD I/O TERMINALS

The VFD shall include, as a minimum, the I/O connections as shown on the motor starter elementary wiring diagrams on the Plans. Provide extended I/O modules, as required, to meet this objective.

The manufacturer shall make all signals to digital input pins available to the PLC over the network. This transmission of data shall be made seamless to the PLC listed in specification 16910.

H. NETWORK COMMUNICATIONS

Where motor starters are shown on the Plans to be networked together or to a PLC, either directly or through network switches, such VFD combination motor starters shall include communications equipment and protocols compatible with the approved system control PLC.

Provide the minimum command and status parameters as shown on the schematic(s) and I/O tables on the Plans.

Provide additional distributed I/O modules and associated power supplies, as required, to meet the data transfer networking requirements listed here and shown on the schematic(s) and I/O tables on the Plans.

The manufacturer shall provide technical assistance to the Integrator as required to create a reliable and clear transfer of data packets between the motor starters and the PLC as identified in Specification 16910.

I. FVNR (BYPASS) STARTER

Provide any additional power contactors, motor protection circuits, isolation contactors, and associated logic control, as required by the drive manufacturer, to provide a complete across-the-line starter as a backup to the VFD drive.

2.6 EXTRA MATERIALS

Reference Specification 16050 for spare parts.

PART 3 EXECUTION

3.1 APPLICATION

Apply motor starters as described on the Plans.

3.2 INSTALLATION

Install independently mounted motor control devices according to manufacturer's written instructions and the NEC.

A. IDENTIFICATION

Identify motor control components and control wiring according to Section 16050.

B. LOCATION AND MOUNTING

Locate controllers as shown on the Plans. Provide the mounting methods for each separate starter enclosure as shown on the Plans. Reference Section 16050.

3.3 WIRING INSTALLATION

- A. Install wiring between motor control devices according to Section 16120.
- B. Bundle, train, and support wiring in enclosures.
- C. Make all control wiring connections to provide a complete and operational system. Provide additional terminals, wire guides, and gutters as required for a safe and protected system.

3.4 CONNECTIONS

Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals including screws and bolts 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.

3.5 FIELD TESTING AND COMMISSIONING

A. GENERAL TESTING REQUIREMENTS

- 1. Testing procedures described herein shall apply to all starters associated with the Project.
- 2. Complete testing of motor starters shall be provided and shall include:
 - a. The services of a qualified independent testing agency to perform breaker testing as described below.
 - b. The assistance of the starter manufacturer's **Field Service Technician (FST)** as described below. Throughout this contract, the Field Service Technician shall be provided by the manufacturer.

Special Note:

Areas of field testing and commissioning where the work responsibilities are shown as "FST/INTEGRATOR" may be performed by either the manufacturer's FST or the Integrator (if so, authorized by the manufacturer and agreed upon by the Integrator). If the work is authorized to be performed by the Integrator, then such work shall not affect the manufacturer's warranty or transfer the manufacturer's liability to the Integrator.

3. Motor starter tests shall also be coordinated with the following representatives:

- a. The System Integrator,
- b. The motor/pump Manufacturer,
- c. The Engineer,
- d. The Owner.

B. TESTING PROCEDURES BEFORE MAKING ELECTRICAL CONNECTIONS TO THE STARTER (FST ASSISTANCE NOT REQUIRED)

1. Megger the motor leads per Specification 16120.
2. If the starter is powered from a separate feeder, then megger the feeder per Specification 16120.
3. For molded case circuit breakers 100 amps and larger, provide independent testing agency to perform circuit breaker tests as stated in NETA ATS, Section 7.6. Certify compliance with test parameters. Provide the Engineer a copy of the test results signed by testing agency.
4. Perform visual and mechanical inspection of enclosure and devices. Remove and replace damaged units with new.
5. Connect power, control, instrumentation, and communication conductors to the motor starter. Verify the integrity of all connections.
6. Remove any burrs, filings, or other foreign materials from enclosure.
7. Completely wipe down and vacuum enclosure.

C. ENGAGING THE FST AT THE JOBSITE PRIOR TO ENERGIZATION

Engage an FST to be present when energizing or commissioning motor starters. Under the direction of the FST, the following minimum tests shall be performed, documented, and dated by the FST. These documents

will be provided as a part of the MCC or Motor Starter Sections of the O&M Manual.

The FST shall:

1. Check connections and device mounting for proper torque.
2. Check alignment of plug-in devices with stationary parts.
3. Check operating mechanisms for binding, lubrication, etc.
4. Verify that all pilot lights are LED type. Replace if not.
5. Verify that analog meters are scaled roughly two times the motor's FLA.
6. Test the validity of the control, instrumentation, and communication circuits.
7. Test all breakers for proper physical movement and door interlocking. Repair or replace as required.
8. Set the motor protection values for the specific motors being controlled.
9. Verify the drive's initial minimum and maximum speed ranges per the table in Section 2.6F.
10. Set the acceleration and deceleration rates per the tables in Section 2.5 and Section 2.6, FACTORY SETTINGS, for RVSS and VFD units respectively.
11. The FST shall energize the starter.

D. SERVICES OF THE FST/INTEGRATOR AT THE JOBSITE AFTER ENERGIZATION

The FST/INTEGRATOR shall:

1. Verify motor rotation and direction. Coordinate this work with the pump/motor manufacturer. Wiring corrections shall be made by the Contractor.
2. Test the starter protection circuits.

3. Test the starter RESET control.
4. Test the starter for proper operation and functionality per design. Verify manual and automatic speed controls and transfers.
5. In coordination with the pump or blower manufacturer, the Owner, and the Engineer, run VFD-controlled motors through their minimum and maximum speed ranges. Identify the frequencies at which the motor speeds cause excessive resonant frequency vibrations (as determined by the pump/blower manufacturer). Identify the frequencies just above and below the resonant frequency and program the VFD drive to lock out the band of frequencies in between (the “notch frequencies”). Perform this task for each resonant frequency. Document the lower and upper frequencies of the lockout bands.
6. Test the starter network communications and functionality with associated PLC or network controller. Coordinate this work with the System Integrator.
7. Test all starter digital and analog I/O connectivity, functionality, and scaling with the PLC, whether hardwired or networked. Coordinate this work with the System Integrator.
8. Test starter cooling fan circuits.
9. Test minimum and maximum speeds.
10. Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

E. ADJUSTMENTS AND STARTER PERFORMANCE VERIFICATION BY THE FST/INTEGRATOR

1. The FST/INTEGRATOR shall provide adjustments, calibrations, and final settings for RVSS units, VFD drives, and Motor Overcurrent Protective (MOP) devices as required to meet design intent and process requirements and make all necessary adjustments and calibrations as required to provide acceptable motor starting and operational performance. Motor nameplate data shall be provided to the FST by the Contractor.
2. The FST/INTEGRATOR shall provide the final OCPD breaker trip setting for the motor circuit being protected.

3. The FST/INTEGRATOR shall document all such adjustments and calibrations in a table similar to that shown below (as a minimum) and initial and date each final setting. This table shall be submitted to Engineering for approval and acceptance. All Status “As Left” conditions must be checked off as “OK” before completion. The final table shall be provided as a part of the MCC or Motor Starter Sections of the O&M Manual.

Parameter Adjusted		Value		Status “As Left”	Date/Time	Test Performed By (Initials)
Ref. No.	Parameter Description	As Found	As Left			

F. AFTER ENERGIZATION

1. Verify motor rotation and direction. Coordinate this work with the pump/motor manufacturer.
2. Test the starter protection circuits.
3. Test the starter RESET control.
4. Test the starter for proper operation and functionality per design. Verify manual and automatic speed controls and transfers.
5. Test the starter network communications and functionality with associated PLC or network controller. Coordinate this work with the System Integrator.
6. Test all starter digital and analog I/O connectivity, functionality, and scaling with the PLC, whether hardwired or networked. Coordinate this work with the System Integrator.
7. Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

G. ADJUSTMENTS AND STARTER PERFORMANCE

1. Make all necessary adjustments and calibrations as required to provide acceptable motor starting and operational performance. Set motor protection circuits against the motor nameplate data.
2. Make the final OCPD breaker trip setting for the motor circuit being protected.

3.6 DEMONSTRATION

A. DEMONSTRATION OF FULLY FUNCTIONAL MOTOR CONTROLLERS

1. Provide all testing required to demonstrate complete functionality for all motor/motor starter systems including speed control, speed notching, manual and auto control, motor acceleration and deceleration, upper and lower speed limits (in manual and auto modes), and motor protection.
2. Provide all testing required to demonstrate complete functionality for all motor/motor starter systems including manual and auto control and motor protection.
3. Cycle power to each starter while their motors are running. Provide a minimum of two cycle tests per motor/starter.

B. TRAINING

1. The FST shall provide basic starter operation training immediately following commissioning.
2. The FST shall provide a minimum of 4 hours of training 30 to 90 days after commissioning (time defined by Owner). The training shall demonstrate FVNR, RVSS, and VFD controller operation and troubleshooting to the Owner's operators and maintenance personnel. Include training related to equipment operation and maintenance procedures.
3. Provide basic starter operation training immediately following commissioning.
4. Provide a minimum of 4 hours of training 30 to 90 days after commissioning (time defined by Owner). The training shall demonstrate starter controller operation and troubleshooting to the

Owner's operators and maintenance personnel as specified in Section 01770. Include training related to equipment operation and maintenance procedures.

5. Schedule training with at least 7 days' advance notice.

3.7 CLEANING

Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

***** END OF SECTION *****

SECTION 16440

PANELBOARDS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of lighting, power, and distribution panelboards, and associated auxiliary equipment rated 600 V and less.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods
16060	Grounding and Bonding

1.3 SUBMITTALS

Submit under the provisions of Section 01300.

A. PRODUCT DATA

For each type of panelboard, accessory item, and component specified.

B. SHOP DRAWINGS

For panelboards. Include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

1. Enclosure type and mounting.
2. Bus configuration and current ratings.
3. Short-circuit current rating of panelboard.
4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

C. PANELBOARD SCHEDULES

For installation in panelboards and inclusion in the maintenance manuals specified in Division 1. Submit final versions prior to closeout of project.

D. MAINTENANCE DATA

For panelboard components to include in the maintenance manuals specified in Division 1. Include manufacturer's written instructions for testing circuit breakers.

1.4 QUALITY ASSURANCE

See Section 16050.

Subject to compliance with requirements, provide products by the following:

A. REFERENCED STANDARDS

1. National Electrical Manufacturers Association (NEMA):
 - a. NEMA 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. NEMA PB 1, Panelboards.
2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
3. Underwriters Laboratories, Inc. (UL):
 - a. 50, Standard for Safety Cabinets and Boxes.
 - b. 67, Standard for Safety Panelboards.

1.5 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

All panelboards associated with a project shall be the same manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. MANUFACTURERS

Subject to compliance with requirements, provide products by the following:

1. General Electric Co.; Electrical Distribution & Control Div.
2. Eaton, Cutler-Hammer.
3. Siemens Energy & Automation, Inc.
4. Square D Co.

2.2 PANELBOARD FABRICATION

A. MANUFACTURED UNITS

Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.

B. RATINGS

1. Bus current, voltage, number of phases, and number of wires as shown on the Plans.
2. Short Circuit Fault Rating
 - a. 250 Vac or Less

10 kAIC minimum short circuit rating or as indicated on the Plans, whichever is the greater.
 - b. 600 Vac or Less

14 kAIC minimum short circuit rating or as indicated on the Plans, whichever is the greater.
3. Service Entry Equipment rated when indicated on the Plans.

C. BUS BARS

1. Main Bus Bars

- a. Plated drawn copper of 98 percent conductivity sized to limit temperature rise to a maximum of 65 degrees C above an ambient temperature of 40 degrees C.
- b. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.

2. Ground Bus

- a. Ground bus shall be full size (100 percent) rated unless shown otherwise on the Plans.
- b. Ground bus shall be bonded to the box.
- c. Provide additional isolated ground bus when indicated on the Plans.
- d. Compression type connectors.

3. Neutral Bus Bars

- a. Insulated, full size (100 percent) rated unless shown otherwise on the Plans.
- b. Compression type connectors.

D. CONSTRUCTION

1. Interiors shall be factory assembled and designed such that switching and protective devices can be replaced without disturbing adjacent unit and without removing the main bus connectors.

2. Multi-Section Panelboards

- a. Feed-through or sub-feed lugs.

3. Main Lugs

- a. Compression type approved for copper and aluminum.

E. ENCLOSURES

1. Boxes
 - a. Code gauge galvanized steel, furnished without knockouts.
2. Trim Assembly
 - a. Code gauge galvanized steel, finished with rust-inhibited primer and manufacturer's standard paint inside and out.
3. Panelboard Mounted Integral to MCC
 - a. Trims supplied with hinged door over all circuit breaker handles.
 - b. Doors on panelboard front, with concealed hinges, secured with corrosion resistant chrome-plated flush catch and tumbler lock, all keyed alike.
 - c. Nominal 20-inch wide by 5-3/4-inch deep with gutter space in accordance with NEC.
 - d. Clear plastic cover for directory card on the inside of each door.
 - e. Rated NEMA 1.
4. Distribution, Lighting and Appliance Panelboard
 - a. Trims supplied with hinged door over all circuit breaker handles.
 - b. Trims for surface mounted panelboards shall be the same size as the box.
 - c. Trims for flush mounted panelboards shall overlap the box by 3/4 inch on all sides.
 - d. Doors on panelboard front, with concealed hinges, secured with corrosion resistant chrome-plated flush catch and tumbler lock, all keyed alike.
 - e. Nominal 20-inch wide by 5-3/4-inch deep with gutter space in accordance with NEC.

- f. Clear plastic cover for directory card on the inside of each door.
 - g. Enclosure
 - i. Outdoor Locations: NEMA 3R unless stated otherwise on the Plans.
 - ii. Indoor Wet Locations: NEMA 12 unless stated otherwise on the Plans.
 - iii. Indoor Dry Locations: NEMA 1 unless stated otherwise on the Plans.
5. Power Distribution Panelboard
- a. Trims cover all live parts with switching device handles accessible.
 - b. Less than or equal to 12-inches deep with gutter space in accordance with NEC.
 - c. Doors on panelboard front, with concealed hinges, secured with corrosion resistant chrome-plated flush catch and tumbler lock, all keyed alike.
 - d. Clear plastic cover for directory card on the inside of each door.
 - e. Enclosure
 - i. Outdoor Locations: NEMA 3R unless stated otherwise on the Plans.
 - ii. Indoor Wet Locations: NEMA 12 unless stated otherwise on the Plans.
 - iii. Indoor Dry Locations: NEMA 1 unless stated otherwise on the Plans.

F. HAZARDOUS AREAS INDICATED ON PLANS

NEMA 250, Type 7C.

G. SERVICE EQUIPMENT APPROVAL

Listed for use as service equipment for panelboards with main service disconnect.

1. Future Devices

Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.

H. SPECIAL FEATURES

Include the following features for panelboards:

1. Skirt for Surface-Mounted Panelboards

Same gage and finish as panelboard front, removable, with flanges for attachment to panelboard, wall, and floor.

I. Provide same size boxes for multisection panelboards.

1. Extra Gutter Space

Dimensions and arrangement as indicated.

2. Subfeed

Overcurrent protective device or lug provision as indicated.

3. Feed-through Lugs

Sized to accommodate feeders indicated.

4. Main Breaker: Vertical mounting.

2.3 OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

A. MAIN OVERCURRENT PROTECTIVE DEVICE

1. Molded-Case Circuit Breaker, NEMA AB 1, handle lockable.

2. Vertical mounting unless stated otherwise in the Plans.

B. BRANCH OVERCURRENT PROTECTIVE DEVICES

1. Shall be bolt-on molded case circuit breakers
2. The minimum breaker size shall be 15 Amp unless stated otherwise on the Plans.
3. Characteristics
 - a. Frame size, trip rating, number of poles, and auxiliary devices as indicated on the Plans.
 - b. Fault current rating as defined herein and as indicated on the Plans.
 - c. Where branch circuit breakers are shown on the Plans to be GFCI the GFCI shall be Class A (5 mA), sometimes called a “Personal Protection” GFCI.
4. Application Listing
 - a. Appropriate for application, including Type SWD for switching fluorescent lighting loads and Type HACR for heating, air-conditioning, and refrigerating equipment.
5. Circuit Breakers, 200 A and Larger
 - a. Trip units shall be interchangeable within frame size.
6. Circuit Breakers, 400 A and Larger
 - a. Field-adjustable short-time and continuous current settings.
7. Circuit breakers, under 200 A
 - a. Thermal-magnetic, trip-free, non-interchangeable, non-adjustable.
8. Lugs
 - a. Mechanical lugs and power-distribution connectors for copper conductors of number and size indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Install panelboards and accessory items according to NEMA PB 1.1.

Setup, adjust and fasten in place flush trim and interiors.

Install circuit breakers as shown on the “Panelboard Schedule” for each panelboard. Record all circuit breaker installation deviations from the “Panelboard Schedule” and show on the Record Drawings the actual size and pole position of all circuit breakers installed.

Do not remove knockouts for breaker positions unless a breaker is to be installed (reference EXTRA MATERIALS, UNUSED CIRCUITS in this Section). Where twistouts or knockouts are removed in error, provide a circuit breaker (one pole, 20-ampere) to fill each position removed.

A. MOUNTING HEIGHTS

Top of trim 74 inches above finished floor, unless otherwise indicated.

B. MOUNTING

Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish. Provide spacers of neoprene or fiberglass to shim out from irregular surfaces or from damp surfaces.

C. CIRCUIT DIRECTORY

Prepare neatly typewritten panelboards directories in the same pole sequence as the panelboard stamping. Send a copy to the Owner for his records. Prior to typing the final directories, verify room and equipment names and numbers with the Owner and modify circuit descriptions of areas/spaces to conform with the Owner’s desires. Obtain approval before installing.

D. PROVISION FOR FUTURE CIRCUITS

Install panelboards in such a manner as to leave access to the box, building chases, knockouts, etc., for future circuit additions. Place conduit in the rear line of knockouts where possible. Install spare conduits from flush-mounted panels up to accessible spaces.

E. **WIRING IN PANELBOARD GUTTERS**

Run neatly parallel and perpendicular to enclosure. Arrange conductors into groups, and bundle and wrap with wire ties.

3.2 IDENTIFICATION

Identify field-installed wiring and components and provide warning signs as specified in Section 16050.

Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.

3.3 GROUNDING

Connect equipment grounding conductors to ground bus, except for circuits requiring isolated grounding.

Provide ground continuity to main electrical ground bus as indicated.

3.4 CONNECTIONS

Tighten electrical connectors and terminals, including grounding connections, 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.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.
2. Make continuity tests of each circuit.

B. **TESTING AGENCY**

Provide services of a qualified independent testing agency to perform specified testing.

C. TESTING

1. Prior to Energization

Provide third party breakers testing per Specification 16050, Section 3.

Perform visual and mechanical inspection of panelboard, bus, and breakers.

Check connections and mounting for proper torque.

Remove any burrs, filings, or other foreign materials. Completely wipe down and vacuum panelboard.

2. After Energization

After electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.6 ADJUSTING

Set field-adjustable switches and circuit-breaker trip ranges as indicated.

***** END OF SECTION *****

SECTION 16442

MOTOR CONTROL EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of motor control equipment rated 600 V and less.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
03300	Cast-In-Place Concrete
16941	Programmable Logic Controller (PLC) Hardware
16050	Basic Electrical Materials and Methods
16420	Motor Controllers
16940	Control Panels

1.3 SUBMITTALS

A. PRODUCT DATA

For each type of motor control center, accessory item, and component specified.

B. SHOP DRAWINGS

Include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

1. Enclosure type, wiring type.
2. Bus configuration, voltage and current ratings for horizontal bus and each separate vertical bus.
3. Short-circuit current ratings.
4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
5. Elevation drawing with dimensions.

6. Identification of units and their location in the MCC.
7. Bill of Materials for each control unit.
8. Wiring diagrams for power distribution circuits.
9. Elementary wiring diagrams for each motor starter including wire numbers, terminal connectivity to contactors, relays, and drive modules. Clearly show field wiring termination points and numbering.
10. Nameplate schedules.

C. FIELD TEST REPORTS

Indicate and interpret test results for compliance with performance requirements.

D. MAINTENANCE DATA

For components to include in the maintenance manuals specified in Division 1.

E. LOAD-CURRENT AND OVERLOAD-RELAY HEATER LIST

Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.4 QUALITY ASSURANCE

See Section 16050. Motor control centers must be factory assembled and wired as completed units by the manufacturer, except where shipping splits are required for shipping of the units. This requirement pertains to control wiring, PLC wiring, and similar wiring within the centers and/or to the “MCC side” of terminal blocks or terminal strips within the centers. Use of a third party to assemble and/or wire the centers is not permitted.

A. SOURCE LIMITATIONS

Obtain similar motor-control devices through one source from a single manufacturer.

B. PRODUCT SELECTION FOR RESTRICTED SPACE

Plans indicate maximum dimensions for motor-control centers, including clearances between motor-control centers and adjacent surfaces and items, and are based on types and models indicated. Other manufacturers' motor-control centers with equal performance characteristics and complying with indicated maximum dimensions may be considered. Refer to Division 1 Section "Substitutions."

1.5 DELIVERY, STORAGE, AND HANDLING

Protect motor control center during construction from moisture, dust, abrasion, or other damage or disfigurement, using plastic sheeting, kraft paper, space heaters, or other appropriate means. Field repair of material or equipment made defective by improper storage is not acceptable.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. MANUFACTURERS

Subject to compliance with requirements, provide products by the following:

1. Allen-Bradley
2. Eaton; Cutler Hammer
3. Square D Co.

2.2 MOTOR CONTROL CENTER FABRICATION

A. RATINGS

1. 600 V class, 3-phase, 60 hertz with operating voltage and number of wires as indicated on the Plans.
2. Bus bracing short circuit fault current rating: as indicated on the Plans.

B. ENCLOSURES

1. Free-standing, totally enclosed, metal-clad structure.

2. Sections nominally 20-inches wide by 20-inches deep by 90-inches high, bolted together to form a continuous assembly.
3. Suitable for mounting against a wall or back-to-back with other electrical units and not requiring rear or side access.
4. Designed to easily extend at either end with similar vertical structures.
5. Provide channel sills where indicated.
6. Enclosure

NEMA 250, Type as indicated on the Plans.

C. WIRING

NEMA ICS 3, Class II, Type B.

1. Class C stranded, single copper conductor; No. 14 AWG minimum size for control wiring, No. 12 AWG minimum size for power wiring.
2. 600 volt rated MTW thermoplastic insulation. Insulation color as follows:
 - a. Red for control circuits internally energized
 - b. Yellow for control circuits externally energized
 - c. Black for power wiring
 - d. White for all grounded conductors
 - e. Blue for dc conductors.

D. WIREWAYS

Continuous both vertically and horizontally.

1. Accessible from the front of the center.
2. Completely isolated from bus compartments and adjacent sections.

3. Vertical wireways adjacent to the slide-in units in each section, but accessible through a separate hinged door running the full height of each section between horizontal wireways.
4. Horizontal wireways at both top and bottom, each intersecting the vertical wireways of every section.

E. BUSING

1. Material

Tin plated copper.

2. Main Horizontal Bus

- a. Ampacity

600 amperes RMS tin plated copper unless otherwise indicated on the Plans.

- b. The main horizontal bus shall be at the top or the center, continuous without splices, except where shipping splits are required. Provide splice bars and hardware for shipping splits. Access to the horizontal bus is by removable barriers.

- c. Extend the main horizontal bus the full length of the MCC with provisions for splicing additional sections to either end.

- d. Lug connections to the bus are bolted.

3. Vertical Buses

- a. Ampacity

Sized for maximum load on vertical section. 300 amperes RMS tin plated copper minimum.

- b. Securely bolted to the main horizontal bus with connections easily accessible for maintenance.

- c. Completely isolated and insulated by means of a barrier.

- d. Continuous from the top of the section to the lowest unit opening possible in the section.
 - e. Lug connections to the bus are bolted.
4. Ground Bus
- a. Ampacity

Tin plated copper, 50 percent of the RMS ampacity of the main horizontal bus. 300 amperes RMS minimum.
 - b. Extend the full length of the MCC with provisions for splicing additional sections to either end.
 - c. Copper ground bus at the bottom of the center, mechanically and electrically connected to each vertical structure.
 - d. Provide ground lug connections.
 - e. Lug connections to the bus are bolted.
5. Bracing
- a. Short circuit fault current rating: as indicated on the Plans.
 - b. Bracing designed to avoid accumulation of dirt, lint, etc., on supports between phases.
 - c. Supports are moisture-resistant, non-carbonizing and non-tracking.
 - d. Bracing designed to avoid accumulation of dirt, lint, etc. on supports between phases.
6. Barriers
- a. Insulated horizontal and vertical bus barriers and a barrier cover below the vertical bus to protect the ends of the bus from contact with items entering the bottom of the enclosure.

F. SECTION UNITS FOR MOTOR CONTROL

1. Units consist of protective/disconnect devices, magnetic starters, control power transformers, control units, pilot lights, relays, terminal blocks and associated wiring mounted on a metal slide-in structure of a modular size.
2. Units of equal rating are interchangeable within the center structure and from center to center.
3. Unit components do not protrude into or restrict wireways.
4. Unit barriers isolate each unit from adjacent units, vertical bus and horizontal bus.
5. Pushbuttons, selector switches, and pilot lights are mounted on the draw-out compartment; but they are visible and operable externally through gasketed, die-cut openings in the unit door. Provide an external reset mechanism for overload relays on the unit door.
6. Plug-in contacts for bus connection of the units are silver plated, free-floating but captive in an insulating block and easily replaceable. The unit plug-in arrangement is completely self-aligning and fail-safe against accidental short or ground. Each plug-in control unit is retained in the structure.
7. Short-circuit protective devices in combination starters and branch circuit protective devices have an external operator. This operator is interlocked with the door so that the circuit must be de-energized before the door can be opened and the device cannot be closed with the door open. A semi-concealed interlock defeat mechanism is provided.
8. The lugs compartment does not interfere with routing of control or power wiring nor interrupt the vertical wireway in the vertical section where it is installed.
9. Locate units as indicated on Plans. Do not revise locations, layout, or number of sections of center from that shown on Plans.

G. IDENTIFICATION

1. Provide a main nameplate for each center, 2" x 10" minimum size with 1/2-inch engraved letters. Nameplate is Lamacoid or equal plastic laminate or engraved metal plate. Lettering is white;

backgrounds are black. No abbreviations are permitted unless approved by the Owner. Engraving is subject to the Owner's approval.

2. Lugs [Main Breaker] compartment is identified by a 1" x 4" nameplate engraved "MAIN LUGS [BREAKER] COMPARTMENT."
3. Each unit door and each slide-in unit shall have a permanently attached, engraved nameplate: 3/8 of an inch letter unless otherwise shown.
4. Provide legend plates for all cover-mounted control devices, including pilot lights, selector switches and pushbuttons. Engraving is subject to the Owner's approval.
5. Provide nameplates for all relays, timers, transformers, fuses, terminal blocks, and switches mounted internally to the unit. Nameplates are Lamacoid sized to the scale of device to which they refer. Engrave as indicated for the device on the elementary wiring diagrams.
6. Identify conductors at each termination by yellow sleeve wire markers of the heat-shrink or stretch-on type with indelible black letters and numbers at each termination or splice.
 - a. The manufacturer's standard internal wiring may be numbered per NEMA or manufacturer's standard.

H. FINISH

Ferrous parts are cleaned, rustproofed and finished with light gray baked enamel. Manufacturer's standard gray colors or accents are acceptable.

2.3 PROTECTIVE AND CONTROL DEVICES

A. CIRCUIT BREAKERS MEET NEMA STANDARD AB-1

1. Main breakers: molded case units with solid state long and short time trip circuits individually and separately adjustable for both time and pickup. Four wire systems have ground trip units. Provide two normally open individual dry auxiliary contacts, rated 10 A at 250 Vac, that open when the breaker is tripped or manually opened; closed when the breaker is closed.

2. Feeder breakers: molded case breakers with thermal magnetic trip, adjustable for magnetic pickup. Provide two normally open individual dry auxiliary contacts, rated 10 A at 250 Vac, that open when the breaker is tripped or manually opened; closed when the breaker is closed.
3. Motor circuit breakers: magnetic only trip with adjustable trip setting. Provide two normally open individual dry auxiliary contacts, rated 10 A at 250 Vac, that open when the breaker is tripped or manually opened; closed when the breaker is closed.
4. Branch circuit breakers: molded case, thermal-magnetic trip, trip-free with non-interchangeable, non-adjustable trip unless otherwise noted.
5. Breakers meet the integrated equipment rating required for the available short circuit current at the equipment in which they are used.
6. All breakers provided in MCC shall be coordinated with respect to their trip points by the MCC manufacturer.

B. MOTOR STARTERS MEET NEMA STANDARD ICS

1. Motor starters shall not include intrinsically safe areas or circuits. Intrinsically safe areas shall be located in electrical enclosures other than the MCC.

Where a field device directly associated with the starter requires an intrinsically safe interface, provide the power to the intrinsically safe circuit from the starter. In this manner, if power is lost to the control panel but the starter is still operable, then the field device and its associated intrinsic interface shall also remain operable.

2. Complete with three overload units of the melting alloy or bimetal type. The overload units are manual reset type.
3. Starter sizes as stated by NEMA, no half or third sizes or IEC devices or ratings are allowed. Minimum size NEMA 1.
4. 600 volt rated, three-pole with 120 Vac control power and 120 Vac coils.

5. Provide three normally open/normally closed (Form C) dry auxiliary contact sets, rated 10 A at 250 Vac, on each starter as a minimum.
 - a. Provide a means of mounting up to two additional auxiliary contact sets on each starter.
 - b. Provide additional auxiliary contact sets as required or indicated for specified functionality and interface with control systems.

C. MISCELLANEOUS PROTECTION AND CONTROL DEVICES

1. Fuses

Power fuses, Class RK-5 silver element. Control fuses, Busman FNQ or equal.
2. Power Monitor Metering

Reference Section 16940, Control Panels.
3. Surge Protection

The main bus of the MCC shall be protected with a Surge Protective Device (SPD). Reference Section 16280.
4. Pilot Devices: Reference Section 16940.
5. Control Relays: Reference Section 16940.
6. Time Delay Relays: Reference Section 16940.
7. Intrinsically Safe Relays: Reference Section 16940.
8. Interval Timers: Reference Section 16940.
9. Running Time Meters

Eagle Signal six digit non-reset or equal.

10. Ammeters

Sized for approximately two times the Full Load motor Amps (FLA), ± 2 percent accuracy, 3-1/2- to 4-inch size, GE "Big Look" or equal, Simpson, Weston, or Crompton.

11. Current Transformers

One percent accuracy at burden and lead length as installed. G.E., Midwest, or Westinghouse.

12. Current Monitor

Reference Section 16940.

2.4 OTHER MOTOR CONTROL CENTER MOUNTED EQUIPMENT

Sections may contain units, equipment or devices other than motor starters such as transformers, panelboards, power factor correction capacitors, metering equipment, programmable logic controllers, or similar devices or equipment. These items are standard products of the same manufacturer as the center and meet the requirements of the specification sections for those items.

Units, equipment, and devices are factory mounted in the center. Locate units, equipment and devices as indicated on Plans. Do not revise locations or layout of center from that shown on Plans.

PART 3 EXECUTION

3.1 INSTALLATION

Install motor control centers and accessory items according to NEMA ICS.

A. MOUNTING

1. Level, plumb and rigid without distortion of enclosure.
2. Install on floor or pad level within $\pm 1/8$ of an inch in a square yard.
3. Shim with stainless steel shims where necessary.
4. Bolt units to the floor with 3/8 of an inch stainless steel expansion anchors and bolts or weld to embedded steel channels.
5. Grout or caulk enclosure to floor or pad.

B. CONDUIT CONNECTIONS

1. Provide bushings on conduits entering from above or at the sides.
2. Provide grounded insulating bushings bonded to the ground bus or pad on conduits entering from below.

C. WIRING IN WIREWAYS

Arrange conductors into groups, and bundle and wrap with wire ties.

- D.** Prior to energization, remove bracing, packing materials, tape on movable parts, etc., as necessary. Check for damage to enclosure, cracked porcelain, chipped bushings, etc.

3.2 IDENTIFICATION

Identify field-installed wiring and components and provide warning signs as specified in Section 16050.

3.3 GROUNDING

Connect equipment grounding conductors to ground bus, except for circuits requiring isolated grounding.

Provide ground continuity to facility electrical ground system as indicated.

3.4 CONNECTIONS

Clean splice plates with Stoddard's Solvent before assembling.

Assemble all shipping splits.

Tighten bus splices, electrical connectors and terminals, including grounding connections, 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.

Check factory connections for proper torque.

3.5 FIELD QUALITY CONTROL

A. TESTING

1. Prior to Energization

Provide third party breakers testing per Specification 16050, Section 3.

After installing disconnect switches and circuit breakers, perform visual and mechanical inspection of enclosure and devices.

Check connections and mounting for proper torque.

Remove any burrs, filings, or other foreign materials from enclosure. Completely wipe down and vacuum enclosure.

2. After Energization

After electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

Correct malfunctioning units on site where possible and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.6 ADJUSTING

Tighten all structural connections, barriers, racking mechanisms, etc.

Check alignment of plug-in devices with stationary parts.

Check operating mechanisms for binding, lubrication, etc.

Set field-adjustable switches and circuit-breaker trip ranges as indicated.

Check continuity and phase uniformity from unit to unit and for all control or metering circuits.

3.7 CLEANING

Vacuum equipment clean after installation; remove metal cuttings with a magnet or suitable means before assembling equipment; wipe insulating supports, bushings, etc., with a clean lint-free cloth; clean debris, shavings, etc., from breakers, bus, switches, relays, and similar components before startup.

***** END OF SECTION *****

SECTION 16460

LOW VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of dry-type distribution and specialty transformers rated 1000 V and less.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods

1.3 SUBMITTALS

Submit under the provisions of Section 01300.

A. PRODUCT DATA

Submit the following:

1. Nameplate ratings
2. Mounting methods
3. Dimensioned plans, sections, elevation views and minimum clearances

B. WIRING DIAGRAMS

Submit manufacturer's wiring diagrams and clearly identify terminals for tap changing and connecting field-installed wiring.

C. FIELD TEST REPORTS

Indicate and interpret test results for tests specified in Part 3.

D. MAINTENANCE DATA

Include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

See Section 16050

1.5 DELIVERY, STORAGE, AND HANDLING

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 is not in a space that is continuously under normal control of temperature and humidity.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Subject to compliance with requirements, provide transformers by one the following:

- A. Cutler-Hammer/Eaton Corp.
- B. GE Electrical Distribution & Control.
- C. Siemens Energy & Automation, Inc.
- D. Square D; Groupe Schneider.

2.2 TRANSFORMERS, GENERAL

A. DESCRIPTION

Factory-assembled and -tested, air-cooled units of types and sizes specified, designed for 60-Hz service.

B. CORES

Grain-oriented, nonaging silicon steel.

C. COILS

Continuous copper windings without splices, except for taps.

D. INTERNAL COIL CONNECTIONS

Brazed or pressure type.

E. ENCLOSURE

Class complies with NEMA 250 for the environment in which installed.

F. SOUND LEVELS

Manufacturer shall guarantee not to exceed the following:

1. Up to 9 kVA: 40 dB.
2. 10 to 50 kVA: 45 dB.
3. 51 to 150 kVA: 50 dB.
4. 151 to 300 kVA: 55 dB.

G. EFFICIENCY

Ventilated, dry type, 15 kVA and larger: Energy efficient meeting DOE 2016 requirements.

2.3 GENERAL-PURPOSE DISTRIBUTION AND POWER TRANSFORMERS

Comply with NEMA ST 20 and list and label as complying with UL 1561.

A. CORES

One leg per phase.

B. WINDINGS

One coil per phase in primary and secondary.

C. ENCLOSURE

As follows unless otherwise indicated.

1. Indoor, ventilated.

D. INSULATION CLASS

185 or 220 degrees C class for transformers 15 kVA or smaller;
220 degrees C class for transformers larger than 15 kVA.

1. Rated Temperature Rise

150 degrees C maximum rise above 40 degrees C for 220 degrees C class insulation; 115 degrees C maximum rise for 185 degrees C class insulation.

E. TAPS

For transformers 3 kVA and larger, full-capacity taps in high-voltage windings are as follows:

1. Taps, 3 through 25 kVA

Two 5-percent taps below rated high voltage.

2. Taps, 25 through 500 kVA

Six 2.5-percent taps, 2 above and 4 below rated high voltage.

F. WALL-MOUNTING BRACKETS

Manufacturer's standard brackets for wall mounted transformers up to 75 kVA.

2.4 CONTROL AND SIGNAL TRANSFORMERS

A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506.

B. RATINGS

Continuous duty. If rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.

C. DESCRIPTION

Self-cooled, 2 windings.

2.5 FINISHES

A. INDOOR UNITS

Manufacturer's standard paint over corrosion-resistant pretreatment and primer.

B. OUTDOOR UNITS

Comply with ANSI C57.12.28.

2.6 SOURCE QUALITY CONTROL

Design and routine factory tests comply with referenced standards.

PART 3 EXECUTION

3.1 INSTALLATION

Comply with safety requirements of IEEE C2.

Arrange equipment to provide adequate spacing for access and for circulation of cooling air.

Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.2 GROUNDING

Comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near the transformer.

Comply with Division 16 Section "Grounding and Bonding" for materials and installation requirements.

3.3 FIELD QUALITY CONTROL

Test to ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the Contract Documents, and is suitable for energizing.

A. TESTS

Include the following minimum inspections and tests according to manufacturer's written instructions.

1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.

2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.
3. Insulation Resistance: Perform megohmmeter tests of primary and secondary winding to winding and winding to ground.

B. TEST FAILURES

Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

3.4 CLEANING

On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.5 ADJUSTING

After installing and cleaning, touch up scratches and mars on finish to match original finish.

Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit with test results.

***** END OF SECTION *****

SECTION 16510

INTERIOR LUMINAIRES

PART 1 GENERAL

1.1 SCOPE

This work specified in this Section covers interior lighting devices, including luminaires, lamps, and power supplies, along with lighting accessories and controls; as well as luminaire mounting, installation, lamping, and testing.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods

1.3 DEFINITIONS

A. BALLAST

The power circuit of a gas-discharge (fluorescent, HID, etc.) lamp. Ballasts are either inductive or electronic.

B. COLOR RENDERING INDEX (CRI)

A figure-of-merit adopted by the Department of Energy that quantifies the color accuracy of lighting devices compared to incandescent light. CRI is normalized such that a score of 100 represents the output of an incandescent lamp.

C. COLOR TEMPERATURE

The color of the light produced by a particular lighting device, measured in kelvin. A higher kelvin temperature results in a “cooler” blue light, while lower kelvin temperatures are “warmer,” and more orange.

D. DIFFUSER

A modifier placed in front of a lamp to change the light intensity and distribution. Part of a LUMINAIRE.

E. DRIVER

The power circuit of an LED LAMP. May be part of a luminaire, or integrated into the lamp itself.

F. EMERGENCY LUMINAIRE

A LUMINAIRE intended to automatically supply illumination to critical areas in the event of failure of the normal supply.

G. ENGINE

See DRIVER in this section.

H. EXIT LIGHT

An illuminated sign or LUMINAIRE intended to indicate the path of egress. An exit light may or may not be an EMERGENCY LUMINAIRE.

I. GAS-DISCHARGE LAMP

General category of lamps that produce light by discharge of electricity through ionized gas. Types include Fluorescent and High-Intensity Discharge (HID). Powered by a BALLAST.

J. LAMP

The part of a LUMINAIRE that produces light.

K. LED LAMP

A lamp that uses Light Emitting Diodes (LEDs) to produce useful light. Powered by a DRIVER.

L. LUMEN MAINTENANCE FACTOR

The percent of the rated lumen output of a lamp still available after a specified period of time. A lamp capable of only half of its original output after will have a lumen maintenance factor of 0.50 or **L50**. May be used to specify the performance of a lamp after a particular number of hours, or the number of hours of operation at a particular level.

M. LUMINAIRE

A complete lighting device, exit light, or emergency lighting device. Luminaires consist of one or more LAMPS mounted in a fixture, along with DRIVERS or BALLASTS to power them, and lenses or diffusers to provide the correct lighting distribution.

N. OCCUPANCY SENSOR

A control device that switches a lighting circuit when a space is occupied.

O. PHOTOCELL

A control device that switches a lighting circuit in response to ambient light level.

P. TOTAL HARMONIC DISTORTION (THD)

The ratio of the root mean square of the harmonic content of a voltage or current signal, expressed as a percent of the magnitude of the fundamental.

1.4 REFERENCES

All applicable ANSI and UL standards.

IES LM-79, LM-80, TM-21.

NFPA 70 [NEC] (latest edition, with Washington State Amendments).

Washington State Energy Code (latest edition).

Washington State Administrative Code [WAC] (current edition).

International Building Code (latest edition, with Washington State Amendments).

1.5 SUBMITTALS

Submit under the provisions of Section 01300.

For each required product, submit data sheets with detailed descriptions of the product to be purchased. Identify each data sheet with the corresponding entry on the Lighting Schedule or Bill of Materials. Where data sheets offer a range of options and accessories, mark or highlight each selection, along with all final part numbers.

A. Submit on each luminaire in the Lighting Schedule. Submittal shall contain the following information, as a minimum:

1. Manufacturer and part number.

2. Product dimensions and weight.
 3. Product environmental rating (NEMA rating).
 4. Electrical ratings:
 - a. Voltage, Current, and Power
 - b. Power factor
 - c. Efficacy
 5. Lighting metrics:
 - a. Lumen output
 - b. Lumen maintenance factor at 25,000 hours
 - c. Color temperature
 - d. Color Rendering Index (CRI)
 - e. Lighting distribution
 6. Regulatory approvals and certifications, including NRTL listing
 7. Battery and charging data (if applicable).
- B. Submit on all lighting controls (switches, photocells, occupancy sensors, etc.). Submittal shall contain the following information, as a minimum:
1. Manufacturer and part number.
 2. Product dimensions and weight.
 3. Environmental rating (NEMA rating).
 4. Electrical ratings (Voltage, Current, and Power).
 5. Regulatory approvals, certifications, and labels.
 6. Wiring diagrams showing both factory- and field-installed wiring for the specific application in this Project. Differentiate between factory- and field-installed wiring.

- C. Submit maintenance data for luminaires and lighting controls in the operation and maintenance manual specified in Section 01300.

1.6 QUALITY ASSURANCE

See Section 16050. Coordinate luminaires, mounting hardware, and trim with all other items to be mounted on the ceiling, and all reserved or classified areas, including work of other trades.

1.7 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

1.8 WARRANTY

A. WARRANTY

1. The manufacturer shall warrant the materials and workmanship of all luminaires for a minimum of 2 years from the time of Substantial Completion.
2. The warranty shall be comprehensive and shall include all components included in the luminaire package.
3. If during the warranty period the manufacturer refuses to honor a claim due to the actions of the contractor, the contractor shall replace all affected items at no cost to the owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include the following:

1. Acuity Brands, Inc.; Holophane, Lithonia
2. Eaton Corp.
3. GE Lighting
4. OSRAM Sylvania, Inc.

B. “OR EQUAL” PRODUCTS

Luminaires shall be the products specified in the Lighting Schedule in the Plans, or equal. Substitute products shall:

1. Use the same lighting technology (LED, Fluorescent, etc.) as the specified luminaire,
2. Have the same lumen output, color temperature, CRI, and IES distribution,
3. Not have an input wattage greater than 110 percent of the specified luminaire, and,
4. Have the same environmental ratings.

2.2 LUMINAIRES

A. POWER

1. Luminaires shall be powered at the voltage specified in the Lighting Schedule.
2. Power supplies, including ballasts, drivers, and transformers, shall be self-contained within luminaires.

B. QUALITY

1. MANUFACTURER LABELS AND MARKINGS

The exterior of lenses and diffusers shall have no visible logos, labels, trademarks, or monograms.

2. METAL PARTS

Metal parts shall be free from burrs, scratches, and sharp corners and edges.

3. TRANSMITTING AND REFLECTING SURFACES

Luminaires shall be provided and installed with all transmitting and reflecting surfaces required to produce the same distribution as the luminaires used as the basis of design, as shown in the Lighting Schedule.

4. FINISH

Provide manufacturer's standard finish, except where otherwise indicated, applied over corrosion-resistant treatment or primer. Finish shall be free from streaks, runs, holidays, stains, blisters, and other defects.

C. MAINTENANCE ACCESS

Any parts of luminaires not subject to the manufacturer's warranty shall be accessible for maintenance and owner-replaceable.

D. UV RADIATION

LED Luminaires shall not emit UV radiation

Luminaires fitted with gas discharge lamps shall block at least 99 percent of the UV radiation emitted by the lamps.

E. WET LOCATION LUMINAIRES

Unless otherwise stated in the Plans, luminaires installed in wet locations shall be rated:

1. NEMA 3R where not subject to splashing or hose-directed water.
2. NEMA 4 where subject to splashing or hose-directed water.
3. NEMA 4X where subject to corrosion or exposed to the process.

Contractor shall provide all materials required to obtain labeled environmental ratings.

F. HAZARDOUS (CLASSIFIED) LOCATION LUMINAIRES

Luminaires shall be NRTL listed for installation in the specific class, division, and group marked in the Plans (see Schedule of Classified Areas; Lighting Schedule).

G. FUSED LUMINAIRES

Provide fused luminaires for applications:

1. Installed more than eight feet above the floor;

2. Powered by 277 V circuits; or
3. Where required by code.

Install a listed fuse and fuse holder approved for the application by the luminaire manufacturer.

H. EMERGENCY AND BATTERY BACKED LUMINAIRES

All emergency luminaires shall be UL 924 listed. Additionally, emergency luminaires located in classified areas shall be UL 844 listed.

Emergency luminaires shall have the following features:

1. Self-contained internal battery, rated to provide a minimum of 90 minutes of emergency level illumination in the event of a power failure.

I. EXIT LIGHTS

All exit lights shall be UL 924 listed, and shall have the following features:

1. Internal illumination, always on.
2. Illuminated arrow indicating direction of egress.
3. Self-contained internal battery, rated to provide a minimum of 90 minutes of emergency level illumination in the event of a power failure.
4. 120VAC input power unless stated otherwise on the Plans.

2.3 LIGHTING TECHNOLOGIES

Each luminaire shall use the technology specified in the lighting schedule.

A. LED LUMINAIRES

LED Luminaires shall conform to UL 1598 (Luminaires) and UL 8750 (LED Equipment for Use in Lighting Products).

1. Drivers

LED Drivers shall be manufacturer approved for the specific model of luminaire to be installed. Drivers shall meet the following specifications:

- a. UL 8750 listed.
- b. Certified by NRTL acceptable to the State of Washington.
- c. Compliant with FCC Part 15, Class A.
- d. Power Factor: greater than 0.90.
- e. Supply circuit THD: less than 10 percent.
- f. Temperature Rating: -20 to +40 degrees Celsius.

2. Lamps

LED Lamps shall be an integral part of the luminaire, and rated to last the entire design lifetime of the luminaire. LED lamps shall have the following specifications:

- a. Color Temperature: 4000K, unless otherwise indicated.
- b. CRI: at least 80 CRI.
- c. Lamp Life: at least 60,000 hours, L80.

PART 3 EXECUTION

3.1 INSTALLATION

A. COORDINATION WITH OTHER WORK

- 1. Coordinate lighting with general electrical work, and with other trades.
- 2. Locate luminaires outside of classified areas and reserved electrical space, unless explicitly called for by the Plans.
- 3. Process equipment and piping has priority over lighting. Luminaires shall be placed to avoid conflict with the process and maintenance thereof.

4. Heating, Ventilation, and Air Conditioning (HVAC) equipment and ductwork has priority over lighting. Luminaires shall be placed to avoid conflict with HVAC.
5. Maintenance vehicle access has priority over lighting. Luminaires shall be placed to not impede maintenance vehicles.
6. Luminaires shall be mounted parallel to finished floor or grade, with no tilt angle unless explicitly called for by the Plans.
7. Adjust stem or chain lengths to suit field conditions where indicated mounting heights are not feasible.

B. LUMINAIRE SUPPORTS

1. Install luminaires with supports, brackets, and trim recommended by the luminaire manufacturer.
2. Bottom of luminaires shall be at the elevation noted in the Plans.
3. Luminaires shall be secured by manufacturer hardware and fasteners. Nails shall not be used to secure luminaires.
4. Supports shall be rated for four times the weight of the luminaire, or 45 kilograms (100 lbs.), whichever is greater. Luminaires weighing more than 23 kilograms (50 lbs.) shall be supported independently from the outlet box.
5. Luminaires shall be supported from building structure or ceiling framing. Provide additional framing to support luminaires that cannot be directly mounted to structural members. Structural integrity shall not be compromised due to installation of luminaires.
6. Hanging luminaires shall be supported at each quarter point and every 8 feet, minimum, by hardware that cannot be dislodged by upward force. Pendants and rods over 120-centimeters long (48 inches) shall be braced to limit swinging.
7. Luminaires in grid-type ceilings shall be supported by additional wires at each corner, independently anchored to the structural system above. Wires shall be the same type and size as the wires supporting the grid ceiling structure.

8. Surface-mounted luminaires shall be installed flush and tight to the finished ceiling. Surface-mounted luminaires more than 45-centimeters wide (18 inches) shall be supported at each corner, in addition to the outlet box.
9. Fluorescent luminaires with lamps longer than 120 centimeters (48 inches) shall be supported independently from the outlet box.

C. INSTALLATION METHODS

1. Unless preempted by other work, luminaires shall be installed at the positions and spacings shown on the Lighting Plan(s). Inform the Engineer of all lighting changes in writing. Plan symbols show the required position of the center of each luminaire, but may be undimensioned.
2. Luminaires in rows or grids shall be installed true to line. Continuous runs of luminaires shall be installed straight and true, with manufacturer's joining hardware.
3. Luminaires located in a common area shall be installed at the same level.

D. ELECTRICAL CONNECTIONS

1. All luminaires shall be grounded.
2. Each luminaire shall be powered by the circuit and operated by the control device(s) shown on the Plans.
3. All luminaires shall be connected according to manufacturer's wiring diagrams.
4. All screw terminals shall be torqued to manufacturer's specifications. If no torque values are published by the manufacturer, terminals shall be torqued to values specified in UL 486A.
5. All luminaires (except emergency luminaires and exit luminaires) shall be fitted with NEC 410.130(G)-type luminaire disconnect plugs. Ideal PowerPlug or equal.
6. Emergency and battery-backed luminaires shall be supplied by both switched lighting conductors AND unswitched charging conductors, powered by the same circuit.

7. Power conductors to exit lights shall not be switched.

E. LIGHTING CONTROLS

Lighting controls shall be installed according to the Plans.

Process areas shall have manual lighting controls.

Restrooms, garages, storage rooms, and other enclosed non-process spaces shall have occupancy sensors.

F. LAMPING

Lamps shall be selected and installed according to the Lighting Schedule and manufacturer's instructions.

Test lamp sockets and holders before installing lamps.

G. ENVIRONMENTAL RATINGS

Installation of luminaires shall meet all manufacturer requirements to maintain labeled environmental ratings.

H. CLEANING

Thoroughly clean dirt and debris from all internal and external surfaces. Vacuum interior of luminaires after installation.

Prior to commissioning, wipe all transmitting and reflecting surfaces with damp cloth.

I. SAFE DISPOSAL

Disposal of lamps and luminaires containing hazardous materials (mercury, etc.) shall comply with state and local rules.

3.2 FIELD QUALITY CONTROL

A. DAMAGED LUMINAIRES

During commissioning, Contractor shall inspect each installed luminaire for damage. Damaged luminaires and components shall be replaced at no cost to the owner. Contractor shall replace any transmitting or reflecting

surface that is scratched, shattered, or otherwise damaged before completion of work at no cost to the owner.

Metal parts that demonstrate corrosion during the project warranty period shall be replaced at no cost to the owner.

Contractor shall provide replacements for any lamps that fail prior to completion of work.

B. TESTING

Contractor shall demonstrate normal operation of each luminaire. Contractor shall interrupt electrical power to demonstrate proper operation of emergency luminaires.

Malfunctioning luminaires and components shall be repaired or replaced, then tested again.

Contractor shall demonstrate each lighting control to show correct operation, and repair or replace malfunctioning controls.

*****END OF SECTION*****

SECTION 16520

EXTERIOR LUMINAIRES

PART 1 GENERAL

1.1 SUMMARY

The work specified in this Section covers exterior lighting devices, including luminaires, lamps, and power supplies; along with outdoor lighting accessories and controls; as well as outdoor mounting hardware, light poles, and accessories; and luminaire mounting, installation, lamping and testing.

1.2 RELATED SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods

1.3 DEFINITIONS

A. BALLAST

The power circuit of a gas-discharge (fluorescent, HID, etc.) lamp. Ballasts are either inductive or electronic.

B. DRIVER

The power circuit of an LED Lamp. May be part of a luminaire, or integrated into the lamp itself.

C. EXTERIOR LUMINAIRE

Any LUMINAIRE mounted in an OUTDOOR AREA (as defined in Specification Section 16050).

D. GAS-DISCHARGE LAMP

General category of lamps that produce light by discharge of electricity through ionized gas. Types include Fluorescent and High-Intensity Discharge (HID). Powered by a BALLAST.

E. LAMP

The part of a LUMINAIRE that produces light.

F. LED LAMP

A lamp that uses an array of Light Emitting Diodes (LEDs) to produce useful light. Powered by a DRIVER.

G. LUMEN MAINTENANCE FACTOR

The percent of the rated lumen output of a lamp still available after a specified period of time. A lamp capable of only half of its original output after will have a lumen maintenance factor of 0.50 or **L50**.

H. LUMINAIRE

A complete lighting device, exit light, or emergency lighting device. Luminaires consist of one or more LAMPS mounted in a fixture, along with DRIVERS or BALLASTS to power them, and lenses or diffusers to provide the correct lighting distribution.

I. PHOTOCELL

A control device that switches a lighting circuit in response to ambient light level.

J. TOTAL HARMONIC DISTORTION (THD)

Total Harmonic Distortion (THD) is defined as the ratio of the sum of the levels of all harmonic components to the level of the fundamental frequency.

1.4 REFERENCES

All applicable ANSI standards.

American Association of State Highway and Transportation Officials [AASHTO]

UL 844, 924, 935, 1029, 1598, 8750.

IES LM-79, LM-80, TM-21.

NFPA 70 [NEC] (latest edition, with Washington State Amendments).

Washington State Energy Code (latest edition).

Washington State Administrative Code [WAC] (current edition).

International Building Code (latest edition, with Washington State Amendments).

1.5 SUBMITTALS

Submit under the provisions of Section 01300.

For each required product, submit data sheets with detailed descriptions of the product to be purchased. Identify each data sheet with the corresponding entry on the Lighting Schedule or Bill of Materials. Where data sheets offer a range of options and accessories, mark or highlight each selection, along with all final part numbers.

A. Submit on each luminaire in the Lighting Schedule. Submittal shall contain the following information, as a minimum:

1. Manufacturer and part number.
2. Product dimensions and weight.
3. Environmental rating (NEMA rating).
4. Electrical ratings:
 - a. Voltage, Current, and Power
 - b. Power factor
 - c. Efficacy
5. Lighting metrics:
 - a. Lumen output
 - b. Lumen maintenance factor
 - c. Color temperature
 - d. Color Rendering Index (CRI)
 - e. Lighting distribution
6. Regulatory approvals, certifications, and labels.

B. Submit on all lighting controls (photocells, motion detectors, etc.). Submittal shall contain the following information, as a minimum:

1. Manufacturer and part number.
2. Product dimensions and weight.
3. Environmental rating (NEMA rating).

4. Electrical ratings (Voltage, Current, and Power).
 5. For luminaires to be mounted on poles:
 - a. Effective Projected Area (EPA)
 6. Regulatory approvals, certifications, and labels.
 7. Detailed wiring diagrams showing both factory- and field-installed wiring for the specific application in this Project. Differentiate between factory- and field-installed wiring.
- C. Submit on all light poles. Submittal shall contain the following information as a minimum:
1. Manufacturer and part number.
 2. Detailed dimensions and weight.
 3. Mounting height.
 4. Anchor bolt design.
 5. Regulatory approvals, certifications, and labels.
 6. Color and manufacturer finish.
- D. Submit maintenance data for luminaires and lighting controls in the operation and maintenance manual specified in Section 01300.

1.6 QUALITY ASSURANCE

See Section 16050. Coordinate luminaires, mounting hardware, light poles with all other items to be mounted on the exterior of buildings, or on the facility grounds, including the work of other trades.

1.7 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. AVAILABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include the following:

1. Acuity Brands, Inc.; Holophane, Lithonia
2. Eaton Corp.; Crouse-Hinds, Cooper
3. GE Lighting
4. OSRAM Sylvania, Inc.

B. "OR EQUAL" PRODUCTS

Luminaires shall be the products specified in the Lighting Schedule in the Plans, or equal. Substitute products shall:

1. Use the same lighting technology (LED, Fluorescent, etc.) as the specified luminaire,
2. Have the same lumen output, CRI, and IES distribution,
3. Not have an input wattage greater than 110 percent of the specified luminaire, and,
4. Have the same environmental rating.

Light poles shall be the products specified in the Lighting Schedule in the Plans, or equal. Substitute products shall:

1. Have the same dimensions (including weight) as the specified light pole,
2. Have the same mounting height and weight/EPA ratings,
3. Meet the harmonic vibration requirements, and,
4. Have the same finish.

2.2 LUMINAIRES

A. POWER

1. Luminaires shall be powered at the voltage specified in the Lighting Schedule.
2. Power supplies, including ballasts, drivers, and transformers, shall be self-contained within luminaires.

B. QUALITY

1. Manufacturer Labels and Markings

The exterior of lenses and diffusers shall have no visible logos, labels, trademarks, or monograms.

2. Metal Parts

- a. Metal parts shall be free from burrs, scratches, and sharp corners and edges.
- b. Sheet metal components shall be corrosion-resistant aluminum, except as otherwise indicated. Sheet metal shall be formed and supported to prevent warping and sagging.
- c. Exposed structural metal shall be stainless steel.

3. Reflecting Surfaces

Minimum reflectance shall be as follows, except as otherwise indicated:

- a. White surfaces: 85 percent.
- b. Specular surfaces: 83 percent.
- c. Diffusing specular surfaces: 75 percent.
- d. Laminated silver metallized film: 90 percent.

4. Transmitting Surfaces

Transmitting surfaces (including lenses, diffusers, covers, globes, etc.) shall be 100 percent acrylic plastic or water-white, annealed crystal glass, except as otherwise indicated.

a. Plastic

High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

b. Lens Thickness

Minimum 3mm (1/8 inch), except where greater thickness is specified.

5. Finish

Provide manufacturer's standard finish, except where otherwise indicated, applied over corrosion-resistant treatment or primer. Finish shall be free from streaks, runs, holidays, stains, blisters, and other defects.

C. HOUSING

1. Luminaire housings shall be rigidly-formed, light-tight enclosures that will not warp, sag, or deform with use.

2. Luminaire housings shall have one of the following environmental ratings:

a. NEMA 3R where not subject to splashing or hose-directed water.

b. NEMA 4 where subject to splashing or hose-directed water.

c. NEMA 4X where subject to corrosion, or exposed to process.

3. Contractor shall provide all materials required to obtain labeled environmental ratings.

D. HAZARDOUS (CLASSIFIED) LOCATION LUMINAIRES

All luminaires shall be placed outside of the boundaries of classified locations.

E. FUSED LUMINAIRES

Provide fused luminaires for applications:

1. Installed more than eight feet above the floor,
2. Powered by 277 V circuits, or,
3. Where required by code.

Install a listed fuse and fuse holder approved for the application by the luminaire manufacturer.

2.3 LIGHTING TECHNOLOGIES

Each luminaire shall use the technology specified in the lighting schedule.

A. LED LUMINAIRES

LED Luminaires shall conform to UL 1598 (Luminaires) and UL 8750 (LED Equipment for Use in Lighting Products). LED luminaires shall have a manufacturer warranty of at least two years.

1. Drivers

LED Drivers shall be manufacturer approved for the specific model of luminaire to be installed. Drivers shall meet the following specifications:

- a. UL 8750 listed.
- b. Certified by NRTL acceptable to the State of Washington.
- c. Compliant with FCC Part 15, Class A.
- d. Power Factor: greater than 0.90.
- e. Supply circuit THD: less than 10 percent.

- f. Temperature Rating: -20 to +40 degrees Celsius.
2. Lamps
- LED Lamps shall be an integral part of the luminaire, and rated to last the entire design lifetime of the luminaire. LED lamps shall have the following specifications:
- a. Color Temperature: 4000K, unless otherwise indicated.
 - b. CRI: at least 80 CRI.
 - c. Lamp Life: at least 60,000 hours, L80.

PART 3 EXECUTION

3.1 INSTALLATION

A. COORDINATION WITH OTHER WORK

- 1. Coordinate lighting with general electrical work, and with other trades.
- 2. Locate luminaires outside of classified areas and reserved electrical space, unless explicitly called for by the Plans.
- 3. Process equipment and piping has priority over lighting. Luminaires shall be placed to avoid conflict with the process and maintenance thereof.
- 4. Heating, Ventilation, and Air Conditioning (HVAC) equipment and ductwork has priority over lighting. Luminaires shall be placed to avoid conflict with HVAC.
- 5. Vehicle access has priority over lighting. Luminaires shall be placed to maintain required clearance above right-of-way.
- 6. Adjust mounting heights to suit field conditions where indicated heights are not feasible.

B. LUMINAIRE SUPPORTS

- 1. Install luminaires with supports, brackets, and trim recommended by the luminaire manufacturer.

2. Luminaires shall be secured by manufacturer hardware. Nails shall not be used to secure luminaires.
3. Luminaires mounted on light poles shall be installed with manufacturer hardware. Luminaires shall be mounted and wired before raising the light pole.
4. Luminaires mounted on building exterior.

C. INSTALLATION METHODS

1. Unless preempted by other work, luminaires shall be installed at the positions and spacings shown on the Lighting Plan(s). Inform the Engineer of all lighting changes in writing. Plan symbols show the required position of the center of each luminaire but may be un-dimensioned.
2. Luminaires in rows or grids shall be installed true to line. Continuous runs of luminaires shall be installed straight and true, with manufacturer's joining hardware.
3. Luminaires located in a common area shall be installed at the same level.

D. ELECTRICAL CONNECTIONS

1. All luminaires and light poles shall be grounded.
2. Each luminaire shall be powered by the circuit and operated by the control device(s) shown on the Plans.
3. All luminaires shall be connected according to manufacturer's wiring diagrams.
4. Each light pole shall have a luminaire disconnect, located in the hand hole. The luminaire disconnect shall deenergize all current-carrying conductors serving the light pole, comply with NEC 410.130 (G), and shall be listed.

3.2 FIELD QUALITY CONTROL

A. DAMAGED HARDWARE

During commissioning, Contractor shall inspect each lighting device. Damaged luminaires, supports, and components shall be replaced at no

cost to the owner. Contractor shall replace any transmitting or reflecting surface that is scratched, shattered, or otherwise damaged before completion of work at no cost to the owner.

Metal parts that demonstrate corrosion during the project warranty period shall be replaced at no cost to the owner.

Contractor shall provide replacements for any lamps that fail prior to completion of work.

B. TESTING

Contractor shall demonstrate normal operation of each luminaire. Contractor shall interrupt electrical power to demonstrate proper operation of emergency luminaires.

Malfunctioning luminaires and components shall be repaired or replaced, then tested again.

Contractor shall demonstrate each lighting control to show correct operation, and repair or replace malfunctioning controls.

***** END OF SECTION *****

SECTION 16910

PLC HARDWARE AND SOFTWARE PROCUREMENT

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of hardware and software procurement of Programmable Logic Controllers (PLCs)

Programming is by others and is not part of this contract.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
16050	Basic Electrical Materials and Methods

1.3 REFERENCES

<u>Reference</u>	<u>Title</u>
NEMA	National Electrical Manufacturers Association
ICS-1	General Standards for Industrial Control and Systems
ICS-1.1	Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control
ICS-4	Terminal Blocks for Industrial Use
ICS-6	Enclosures for Industrial Controls and Systems
Publication NO 250	Enclosures for Electrical Equipment (1000 V maximum)
NFPA	National Fire Protection Association
NEC	National Electric Code

1.4 SYSTEM DESCRIPTION

A. HARDWARE AND SOFTWARE REQUIREMENTS

1. The system includes racks, central processing units (CPUs), input/output (I/O) modules, communication modules, power supplies, and associated accessory items to provide a complete and functional process control system for the facility.
2. The system includes development and application software required by the PLC hardware to provide complete operational functionality for the facility.

B. PERFORMANCE REQUIREMENTS

1. The installed system is capable of performing the functional and operational algorithms required for control of the process.

1.5 DEFINITIONS

Reference specification 16050.

1.6 SUBMITTALS

- A. Submit under the provisions of Specification Section 01300.

B. PRODUCT DATA

1. Submit an electronic version of the manufacturer's data sheets for hardware components including specific model numbers for each device and size of memory provided in each CPU.
2. Submit an electronic version of the manufacturer's installation and user's manuals.
3. If required by the software manufacturer provide a "runtime" license of the software to the Owner and provide copies of the license agreement to the Owner.

C. OPERATION AND MAINTENANCE MANUALS

1. Provide specific information including:
 - a. An electronic version of the manufacturer's published operation and maintenance manual, user's manual, and troubleshooting guide.
 - b. Information for obtaining assistance and troubleshooting, parts ordering information, and field service personnel requests.

1.7 QUALITY ASSURANCE

A. QUALIFICATIONS

Programmer must have testing hardware and sufficient programming experience to demonstrate operational functionality per Section 2 herein.

1.8 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements, provide products by the following manufacturers:
 - 1. Allen Bradley Company.
 - 2. General Electric Company.
 - 3. Siemens.
 - 4. Square-D.
- B. The PLC programming software must be the latest version and must be of the same Manufacturer as the PLC hardware.

2.2 EQUIPMENT

- A. Conform to NEMA ICS 1.1 for installation and application of the PLC system.

2.3 COMPONENTS

Hardware is referenced against Allen Bradley PLC products. Other suppliers listed under “MANUFACTURERS” in Section 2 may be selected as “or equal” substitutions to the list below.

The PLC CPU, I/O, and communication cards shall be provided with the latest version of firmware.

- A. CENTRAL PROCESSOR UNIT (CPU)

- Allen Bradley: MicroLogix 1400
- Allen Bradley: L24E Compact Logix family
- Allen Bradley: L36E Compact Logix family
- Allen Bradley: ControLogix family

B. ANALOG INPUT/OUTPUT (I/O) MODULES

Provide modules as defined in the PLC I/O tables in the Plans. Manufacturers other than Allen Bradley shall match the features and performance criteria of the Allen Bradley products listed below:

1. Analog Input Cards

Type 1:

Allen Bradley P/N 1769-IF4I:

Channels:	4
Input Type:	4-20 mA
Resolution:	16 bit or +/-15 bit
Differential?	Yes
Isolated?	Yes

Type 2:

Allen Bradley P/N 1769-IF8:

Channels:	8
Input Type:	4-20 mA
Resolution:	16 bit or +/-15 bit
Differential?	Yes
Isolated?	No

2. Analog Output Cards

Type 1:

Allen Bradley P/N 1769-OF4CI:

Channels:	4
Input Type:	4-20 mA
Resolution:	16 bit
Differential?	Yes
Isolated?	Yes

Type 2:

Allen Bradley P/N 1769-OF8C:

Channels:	8
Input Type:	4-20 mA
Resolution:	16 bit
Differential?	No
Isolated?	No

C. DIGITAL INPUT/OUTPUT (I/O) MODULES

Provide modules as defined in the PLC I/O tables in the Plans. Manufacturers other than Allen Bradley shall match the features and performance criteria of the Allen Bradley products listed below:

1. Digital Input Cards

Type 1:

Allen Bradley P/N 1769-IQ16, no exceptions:

Input Channels:	16
Input Voltage:	24 VDC
Signal Polarity:	Sinking/Sourcing (configure card for sourcing; +24VDC = true)

Type 2:

Allen Bradley P/N 1769-IQ32, no exceptions:

Input Channels:	32
Input Voltage:	24 VDC
Signal Polarity:	Sinking/Sourcing (configure card for sourcing; +24VDC = true)

Type 3:

Allen Bradley P/N 1769-IA16, no exceptions:

Input Channels:	16
Input Voltage:	120 VAC
Signal Polarity:	Sourcing

2. Digital Output Cards

Type 1:

Allen Bradley P/N 1769-OB16, no exceptions:

Output Channels:	16
Output Voltage:	24 VDC
Signal Polarity:	Sourcing

Type 2:
Allen Bradley P/N 1769-OB32, no exceptions:

Output Channels: 32
Output Voltage: 24 VDC
Signal Polarity: Sourcing

Type 3:
Allen Bradley P/N 1769-OW16, no exceptions:

Output Channels: 16
Output Voltage: Relay, Form A

Type 4:
Allen Bradley P/N 1769-OA16, no exceptions:

Output Channels: 16
Output Voltage: 120 VAC
Signal Polarity: Sourcing

D. POWER SUPPLY UNITS

Manufacturers other than Allen Bradley shall match the features and performance criteria of the Allen Bradley products listed below:

1. For racks using separate power supplies, use the largest power supply available for that specific rack.

Allen Bradley P/N 1769-PB4, no exceptions:

Input Voltage: 24 VDC
5 VDC Ampacity: 4 Amps
24 VDC Ampacity: 2 Amps

2.4 ACCESSORIES

Provide all accessories required, whether indicated or not, for a complete PLC control system to accomplish the requirements of the Plans and Specifications.

2.5 SOURCE QUALITY CONTROL

A. SHOP TEST

1. Submit a shop test plan indicating how the test will be conducted, and how equipment operation will be verified.

2. Provide a shop test after factory assembly of the PLC control panel and prior to shipment including the following:
 - a. Conduct a burn-in period (minimum of 2 days) where the system is powered continuously and checked for proper operation and operating temperature.
 - b. Provide sufficient PLC programming to demonstrate PLC I/O testing. Include a PC with sufficient software tools to allow visual demonstration of each digital/analog input status/value and be capable of forcing digital and analog outputs. Coordinate effort with PLC programmer if required.
 - c. Utilize dummy I/Os to verify proper operation.
 - d. Demonstrate that all PLC hardware is fully functional.
 - e. Allow for Owner and/or Engineer representatives to witness the shop test. Provide a minimum of 15 days notice prior to test.
 - f. Do not ship the system prior to successful completion of this testing.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install PLC control system in accordance with manufacturer's written instructions.
- B. Test, verify and demonstrate access to and functionality of PLC system.

***** END OF SECTION *****

SECTION 16940
CONTROL PANELS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes control panels [02 CP 02].

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
13450	Programmable Logic Controller (PLC) Hardware
Division 16	Electrical

1.3 DEFINITIONS

A. CONTROL PANELS

Reference Section 16050.

B. CONTROL POWER

Control power is considered electrical power at either 120 VAC or 24 VDC that powers control or instrumentation devices. Control power circuits are less than 150 VAC and less than or equal to 20 Amps.

Examples:

1. 120 VAC or 24 VDC device power to instruments such as flow meters, chlorine analyzers, dissolved oxygen transmitters, etc.
2. 120 VAC or 24 VDC device power to control devices such as PLCs, radios, network switches, etc.
3. 120 VAC power to control devices such as motor operated valves, metering pumps (even when through dedicated receptacles), lighting circuits (controlled within a lighting control panel), and etc.

1.4 REFERENCES

<u>Reference</u>	<u>Title</u>
NEMA ICS-1	General Standards for Industrial Control and Systems
NEMA ICS-4	Terminal Blocks for Industrial Use
NEMA ICS-6	Enclosures for Industrial Controls and Systems
NEMA 250	Enclosures for Electrical Equipment (1000 V maximum)
NFPA 70	National Electric Code (NEC)
NFPA 79:	Electrical Standard for Industrial Machinery
JIC-EMP-1	Electrical Standard for Mass Production Engineering

1.5 SYSTEM DESCRIPTION

A. CONTROL PANELS

1. Reference Section 16050, Definitions.
2. Control panels shall be fabricated similar to those shown on the Plans. With the exception of the discrete and analog I/O terminal blocks, the exact dimensions and component layout is not critical.
3. The system includes new control panels for control of process equipment. Some of the control panels are provided under Division 16. Some panels are provided under other Divisions with equipment specified in those Divisions. Control panels, whether provided under Division 16 or other Divisions, shall meet the requirements of this Section.

1.6 SUBMITTALS

A. SHOP DRAWINGS

1. See Section 01300.
2. Dimensioned or to-scale panel layout drawings.
3. Materials of construction.
4. Drawings showing conduit and wiring access locations.
5. Elementary wiring diagrams and terminal block drawings, differentiating between panel and field wiring.

6. Bill of Materials describing the reference name or number, quantity, complete English language description, manufacturer, model number, local supplier, and wiring or piping reference. Information shall include manufacturer name, catalog descriptions, wiring and piping diagrams, dimensional plans, anchoring details, installation instruction, and test results.
7. Loop diagrams with all components connected per ISA standards.
8. Nameplate text.
9. Heat calculations and relationship to enclosure fan, heater, air conditioner.
10. UPS system loading and resulting back-up run time.

B. OPERATION AND MAINTENANCE MANUALS

1. See Section 01300.
2. Provide manufacturer's operating and maintenance manuals for each device or item provided.
3. Recommended spare parts stocking list.

C. CONTRACTOR CERTIFICATION

1. If the submitted panel(s) are to be labelled and listed with an agency other than UL, submit proof of certification as a panel shop by that agency. For UL listed panels, the Contractor fabricating panels shall submit proof of certification as a UL 508A and/or UL 698A (if required) panel shop upon request.

1.7 QUALITY ASSURANCE

- A. Make shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with panel access locations.
- B. Test panels prior to shipment to project site.
 1. The entire assembled panel shall be tested to be free from grounds and shorts.
 2. Controllers, circuits, and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped.

Prior to placement of conduit feeds, assure approved control panel layouts are available.

- C. Panels supplied under this Section are provided by a single manufacturer.
- D. Provide panels labeled by a recognized testing laboratory acceptable to the State of Washington Department of Labor and Industries meeting the requirements of Article 409 of the NEC.
- E. Revise all drawings upon completion of the work to show “as shipped” condition of the panel.

1.8 STORAGE AND HANDLING

- A. After completion of shop assembly and testing, enclose panels in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from dust and moisture. Place dehumidifiers inside the polyethylene covering.
- B. Skid-mount the equipment for final transport. Show shipping weight on shipping tags, together with instructions for unloading, transporting, storing, and handling on job site.

1.9 EXTRA MATERIALS

Reference Specification Section 16050 for spare parts.

PART 2 PRODUCTS, MATERIALS

2.1 CONTROL PANEL ENCLOSURES

A. ENCLOSURE BODIES

Control panel enclosures are factory listed and labeled enclosures fabricated of stretcher leveled steel welded into a rigid, self-supporting structure. Control panels shall be completely enclosed, welded construction, self-supporting, and gasketed dust-tight.

1. Panels mounted outdoors or in below-ground vaults shall be NEMA 4X 316L stainless steel.

Exception:

- *Unless indicated otherwise in the Plans.*

2. Panels mounted indoors shall be NEMA 1 gasketed.

Exception:

- *Unless indicated otherwise in the Plans.*

B. HINGES AND HINGE PINS

1. Provide full length (continuous) piano hinges rated for 1.5 times the weight of the door plus all door-mounted instruments.
2. Hinges shall be welded to all surfaces and shall match the metallurgy of the enclosure.
3. Hinge pins shall be 316L stainless steel on all panels.

C. MOUNTING FEET

If called for, mounting feet shall be the height indicated on the Plans and shall be made of the same material as the enclosure body that it supports.

2.2 CONTROL PANEL POWER DEVICES

A. FUSES

1. Power Circuit Fusing

Reference Specification 16410, Enclosed Switches, Fuses, and Circuit Breakers.

2. Control Power Fusing

Control power fuses are FRN for ratings above 10 amperes and FNQ for 10 amperes and below. FRN fuses are mounted in phenolic blocks with a fuse puller mounted adjacent to them. FNQ fuse holders are DIN-rail mounted type, 12A, 300 V minimum, hinged to disconnect and replace fuse, with blown fuse indicating light. Label all fuseholders with fuse identification number and fuse size and type. Provide five spare fuses of each type and size in each panel. Provide box mounted on panel interior marked "SPARE FUSES" to hold the spares.

3. PLC I/O Field Connection Fusing

a. 24 VDC Fusing

- i. Fuses for 24 VDC circuits shall be 5 x 20 mm, glass body, fast acting, 250 VAC, sized by the integrator unless specifically called in the Plans or Specifications.
- ii. Fuse holders for 24 VDC circuits shall be DIN-rail mounted type, provided in fusible terminal blocks, for 5 x 20 mm fuses, black, hinged to open, 10-57 VAC/VDC, with red LED blown fuse indicators, #30 AWG - #12 AWG, 15A.

b. 120 VAC Fusing

- i. Fuses for 120 VAC circuits shall be 1/4" x 1-1/4", glass body, time-delay, 250 VAC, sized by the integrator unless specifically called in the Plans or Specifications.
- ii. Fuse holders for 120 VAC circuits shall be DIN-rail mounted type, provided in fusible terminal blocks, for 1/4" x 1-1/4" fuses, black, 100-300 VAC, with neon blown fuse indicators, #30 AWG - #12 AWG, 15A.

B. CIRCUIT BREAKERS

1. Power Circuit Breakers

Reference Specification 16410, Enclosed Switches, Fuses, and Circuit Breakers.

2. Control Power Circuit Breakers

Control power circuit breakers shall be DIN-rail mounted type, miniature, 240 VAC, single pole, 10 k AIC (minimum) @ 240 VAC, "C" curve (inductive) trip characteristics, 1,500 VAC dielectric strength (minimum), #14 to #12 AWG 75 degrees C line and load screw terminals, UL 489, CSA 22.2 No. 5.1; Allen Bradley Bulletin 1492-SPU Series A or equal.

C. DISCONNECT SWITCHES AND ACTUATORS

1. For Power Circuits > 30 Amps

Reference Specification 16410, Enclosed Switches, Fuses, and Circuit Breakers.

2. For Power Circuits \leq 30 Amps

a. For Single Phase Circuits

Load disconnect switches shall be 2-position, OFF-ON, 90 degree, 600 VAC, 20 A or 32 A rating, single pole, front door installation; Allen Bradley 194L-E **aa**-1751 or equal, where **aa** = 20 for 20 A unit and **aa** = 32 for 32 A unit.

Associated switch actuators shall be OFF-ON, 90 degree, front/door installation, IP66 rated, 22.5 mm central hole mount, square, red/yellow handle with padlock provision, 48 mm x 48 mm; Allen Bradley 194L-HC4L-175I or equal.

b. For Three Phase Circuits

Load disconnect switches shall be 2-position, OFF-ON, 90 degree, 600 VAC, 20 A or 32 A rating, 4-pole, front door installation; Allen Bradley 194L-E **aa**-1754 or equal, where **aa** = 20 for a 20 A unit and **aa** = 32 for a 32 A unit.

Load disconnect switch actuators shall be OFF-ON, 90 degree, front/door installation, IP66 rated, 22.5 mm central hole mount, square, grey/black handle with padlock provision, 64 mm x 64 mm; Allen Bradley 194L-HC6E-175I or equal.

When being used as a 3 PH motor safety disconnect switch, reference Specification 16410, Enclosed Switches, Fuses, and Circuit Breakers.

D. SURGE PROTECTIVE DEVICES

1. For Power Circuits > 150 VAC and > 30 A

Reference Specification 16280, Surge Protective Devices.

2. For Control Power Circuits

Control power SPDs shall protect L-N, L-G and N-G and have a minimum peak surge current of 40kA, shall have terminals that accept a #12 AWG conductor, shall be rated for the voltage shown in the Plans, shall be listed, and shall have a terminal configuration with separate Line, Neutral, and Ground connections.

Control power SPDs shall meet Mil-Std-220 for maximum EMI/RFI attenuation.

Control power SPDs shall be DIN-rail mounted, 1-inch wide maximum.

Control power SPDs shall be Cooper Bossman #BSPM1120S2G or equal.

3. For Telecommunications

All incoming phone and internet services shall be provided with surge protection.

- a. Intermatic IG2TM or equal for twisted pair copper.
- b. Intermatic IG4TM or equal for coaxial cable.

E. UPS SYSTEMS

1. 24 VDC UPS Systems

24 VDC UPS Systems shall include the 24 VDC power supplies, the converters, batteries, and redundancy modules as described herein. Each of these devices shall be DIN-rail mounted, industrial rated, packaged, and listed. Custom built circuits boards and loose electronic devices shall not be allowed. Provide a minimum of 30 minutes of backup time or that shown on the Plans, whichever is the greater.

- a. A single 24 VDC UPS system shall include, as a minimum, the following devices:
 - i. 1x 24 VDC Power Supply;
 - ii. 1x 24/12 VDC UPS Controller;

- iii. 1x 12 VDC Backup Battery.
- b. A dual (paralleled) 24 VDC UPS systems shall include, as a minimum, the following devices:
 - i. 2x 24 VDC Power Supplies;
 - ii. 2x 24/12 VDC UPS Controllers;
 - iii. 2x 12 VDC Backup Batteries;
 - iv. 1x 24 VDC DC Redundancy Module.

The minimum DC UPS system shall be capable of providing 10 Amps at 24 VDC continuously. The specifications listed below are for a minimum system. Increase the system ampacity as called on the Plans.

c. 24 VDC Power Supplies

24 VDC power supplies shall be 120 VAC input, 24 VDC output, 10 A minimum, with +/- 1 percent voltage regulation from no-load to full-load. Process power supplies shall be sized by the integrator and increased in size as required. Provide the power supply sizing calculations with the product submittal.

- i. 10 A: PULS #QS10.241 or equal.

d. 24 VDC UPS Controllers

DC UPS controllers shall be 24-28 VDC normal input, 12 VDC battery input with a 24 VDC, 10 A output (minimum) and a 12 VDC, 5 A output, with indicating LEDs. The unit shall monitor the battery and provide a dry contact output to indicate that the battery should be replaced.

- i. 24 VDC @ 10 A, 12 VDC @ 5A: PULS #UB10.245 or equal.

e. 12 VDC Backup Batteries

Batteries shall be fully sealed gel type. Batteries shall be rated for 12 Ah (minimum) and rated to operate between -40 degrees C to 60 degrees C.

f. DC Redundancy Module

DC Redundancy Modules provide parallel connectivity of two separate 24 VDC systems and are required on all dual 24 VDC supply systems.

Provide DC Redundancy module, 24 VDC/24 VDC input, 24 VDC output, 20 Amp; PULS YR2.DIODE or equal.

F. POWER MONITOR UNITS (PMU)

Power monitor unit shall be of the same manufacturer as the PLC. 3 phase power monitor units shall be complete with the following:

1. Current Transformers (CTs)

Mechanical and thermal ratings of transformers shall be coordinated with that of the equipment in which they are mounted. Basic impulse level shall be 10 kV and accuracy class shall be 0.3 for B-0.1, B-0.2, and B-0.5 burdens. A clearly visible nameplate shall give complete transformer characteristics.

Three independent current transformers shall be provided with 5 ampere secondary current at the primary current ratio indicated.

- a. For new installations, provide doughnut style current transformers.
- b. For existing installations, provide split core style current transformers.

2. Potential Transformers (PTs)

Potential transformers shall only be allowed for PMUs connected to circuits > 600 VAC. For < 600 VAC, provide PMUs that connect directly to the measured bus.

3. Fusing

Provide all required fusing and fuse blocks.

4. The Power Monitor Unit

The PMU shall have the following features and functions.

- a. Front panel mountable.
- b. Powered from the unit's PTs or directly off of the measured bus. A separate power source shall not be required.
- c. LED display or an LCD backlit display.
- d. Capable of transmitting measured data over the network type that is used by the PLC/HMI systems. All hardware and software shall be included to provide a complete and functional network interface.

5. Measurement Capabilities

The PMU shall measure and transmit the following:

- RMS Voltage line-to-line and line-to-neutral for all three phases with an accuracy of +/-0.3 percent of full scale.
- RMS current per phase with an accuracy of +/-0.3 percent of full scale.
- Real power (in kW), 3 Phase total with an accuracy of +/-0.6 percent of full scale.
- Apparent power (in kVA), 3 Phase total with an accuracy of +/-0.6 percent of full scale.
- Reactive power (in kVAR), 3 Phase total with an accuracy of +/-0.6 percent of full scale.
- Power Factor (PF) with an accuracy of +/-1.0 percent of full scale.
- Frequency in Hertz with an accuracy of +/-0.2 percent of full scale.

- Voltage Total Harmonic Distortion in Percent to the 31st harmonic.
- Current Total Harmonic Distortion in Percent to the 31st harmonic.
- RMS Average Current.
- RMS Average Voltage.
- kW-Hours.
- kVAR-hours.
- Peak Average kW with date/time stamp.
- Peak Average kVA with date/time stamp.
- Peak Average kVAR with date/time stamp.
- Peak kW Demand with date/time stamp.
- Peak kVAR Demand with date/time stamp.
- Peak Maximum Current for each phase with date/time stamp.
- Peak Maximum Voltage for each phase with date/time stamp.
- Peak Minimum Voltage for each phase with date/time stamp.

6. Annunciation

The PMU shall provide an instantaneous dry contact Form C alarm that transitions under any selectable combination of the following conditions:

- Phase Loss.
- Phase Reversal.
- Phase Imbalance (with adjustable setpoint and time delay).

- Overvoltage (with adjustable setpoint and time delay).
- Undervoltage (with adjustable setpoint and time delay).
- Overcurrent (with adjustable setpoint and time delay).

G. PHASE MONITOR RELAYS (PMRs)

1. PMRs shall only be used on 3 phase power systems and shall be compatible with the voltage configuration as shown on the Plans. For 240 VAC 3 phase systems, the high leg shall be phase B.
2. PMRs shall monitor the following conditions and provide the ability to adjust trip values and time delays as described below:
 - a. Phase Loss
 - i. Trip not adjustable
 - ii. Time delay not adjustable, fixed at 100 msec.
 - b. Phase Reversal
 - i. Trip not adjustable
 - ii. Time delay not adjustable, fixed at 100 msec.
 - c. Phase Unbalance
 - i. Trip adjustable, set at 10 percent
 - ii. Time delay not adjustable, fixed at 2 seconds.
 - d. Under voltage
 - i. Trip adjustable, set at 80 percent of nominal voltage
 - ii. Time delay adjustable, set at 5 seconds.
 - e. Overvoltage
 - i. Trip not adjustable, fixed at 110 percent of nominal voltage

- ii. Time delay not adjustable, fixed based on inverse time.
- 3. PMRs shall be provided with 1x SPDT (Form C) dry isolated contact that transitions when thresholds are exceeded for time delays described above.
- 4. PMRs shall be: Automation Direct, Prosense, PMRU-1C-480A or equal.

H. MOTOR START COUNTERS/MOTOR RUN TIME (ELAPSED TIME) METERS

When the control panel contains motor starters, start counter and run time meter shall be a combination electromechanical device. Eaton CEC-55PM-406 or equal. Battery backed LCD displays shall not be used. Refer to Specification 16420, Motor Controllers.

I. CURRENT TRANSFORMERS

Current transformers are 1 percent accuracy at burden and lead length as installed. G.E., Midwest, Westinghouse or Hawkeye.

J. AMMETERS

Ammeters are ± 2 percent accuracy, 2-1/2-inch size GE, Simpson, Weston, or Crompton.

K. ANALOG CURRENT TRANSMITTERS

Loop powered 4-20 mA solid core current transducer for currents up to 200 A. Hawkeye H721 Series or equal.

2.3 CONTROL PANEL CONTROL DEVICES

A. PILOT LIGHTS

- 1. Pilot lights shall be heavy duty, Class 9001, Type J, NEMA 4 (watertight) and NEMA 13 (oil-tight), metal collar, push-to-test, multi-segmented LED with red, green, amber, blue, clear, white, or yellow colored caps as shown on the Plans.
 - a. Allen-Bradley
 - b. Cutler-Hammer

- c. General Electric
- d. Siemens
- e. Square D

B. PUSH BUTTONS

1. Push buttons shall be heavy duty, Class 9001, Type K, UL Types 4 and 13, NEMA 4 (watertight) and NEMA 13 (oil-tight), metal collar, non-illuminating, with full button guard. Contact block shall be provided with 1 N.O. and 1 N.C. contacts minimum with the ability to stack additional blocks. Provide additional blocks as required.

Pushbutton actuators may be standard, mushroom head, recessed (flush collar), or deep recessed (deep collar) as required.

- a. Allen-Bradley
- b. Cutler-Hammer
- c. General Electric
- d. Siemens
- e. Square D

C. SELECTOR SWITCHES

1. On-Off Selector Switches

ON-OFF selector switches shall be Class 9001, Type K, UL types 4 and 13, NEMA 4 (watertight) and NEMA 13 (oil-tight), metal collar, non-illuminating push button contact blocks with 2-position operators and standard knob. Contact block shall be provided with 2 N.O. and 2 N.C. contacts minimum with the ability to stack additional blocks. Provide additional blocks as required.

The 2-position operator shall be manual rotation to left and manual rotation to right. Two contact block stacks shall be provided. In both contact block stacks, one set of contacts is closed in the left position and open in the right position. In both contact block

stacks, one set of contacts is closed in the right position and open in the left position.

- a. Allen-Bradley
- b. Cutler-Hammer
- c. General Electric
- d. Siemens
- e. Square D

2. Hand-Off-Auto (HOA) Selector Switches

HOA selector switches shall be Class 9001, Type K, UL types 4 and 13, NEMA 4 (watertight) and NEMA 13 (oil-tight), metal collar, non-illuminating push button contact blocks with 3-position operators and standard knob. Contact block shall be provided with 2 N.O. and 2 N.C. contacts minimum with the ability to stack additional blocks. Provide additional blocks as required.

The 3-position operator shall be manual rotation to left and right from center and manual return back to center. Two contact block stacks shall be provided. In both contact block stacks, one set of contacts is closed in the left position and open in the center and right positions. In both contact block stacks, one set of contacts is closed in the right position and open in the center and left positions.

- a. Allen-Bradley
- b. Cutler-Hammer
- c. General Electric
- d. Siemens
- e. Square D

3. Reset-Off-On Selector Switches

RESET-OFF-ON selector switches shall be Class 9001, Type K, UL types 4 and 13, NEMA 4 (watertight) and NEMA 13 (oil-tight), metal collar, non-illuminating push button contact

blocks with 3-position operators and standard knob. Contact block shall be provided with 2 N.O. and 2 N.C. contacts minimum with the ability to stack additional blocks. Provide additional blocks as required.

The 3-position operator shall be manual rotation to left and right from center, spring return from left to center and manual return from right to center. Two contact block stacks shall be provided. In both contact block stacks, one set of contacts is closed in the left position and open in the center and right positions. In both contact block stacks, one set of contacts is closed in the right position and open in the center and left positions.

- a. Allen-Bradley
- b. Cutler-Hammer
- c. General Electric
- d. Siemens
- e. Square D

D. RELAYS

Regardless of the technology of a relay's control (from simple to programmable), the relay's output technology shall be the electro-mechanical type. Electronic outputs (triacs, thyristors, transistors, etc.) shall not be allowed.

Exceptions:

- *Unless specifically shown otherwise on the Plans.*
- *Unless approved in writing by the Engineer.*

1. Contactor relays

Contact relays for switching 120 VAC power circuits including, but not limited to, lighting, solenoid valves, and small motors shall be electro-mechanical machine tool, heavy-duty type, NEMA rated, with 120 VAC/24 VDC coils and double-break contacts rated at 20 A at 250 VAC. Equip relays with surge suppressers. IEC rated relays are not permitted.

2. Control relays

Control relays for logic control circuits shall be permitted to be miniature “ice cube” type DPDT or 4PDT with 24V or 110-120V AC/DC coils with a mechanical life of 20 million operations minimum and an electrical life of 1 million operations minimum at 1 amp. The dielectric strength between the coil and contacts shall be 2,000 VAC for 1 minute. Contacts shall be rated at 10A at 250 VAC, 10A at 30 VDC. Relays shall have a maximum pickup and release time of 25 milliseconds and a minimum drop voltage of 30 percent of the rated voltage. Relays shall include non-polarized LED coil indicators. Relays shall be IDEC, P&B/Tyco or equal.

3. Alternating relays

Alternating relays shall have 24 VDC or 120 VAC coils as required for the application.

a. Duplex Alternating Relays

2-state alternating relays shall be DPDT with the transition between states occurring on loss of power to the coil.

b. Triplex Alternating Relays

Triplex alternating relays shall operate on 3 switch inputs, with the loads falling out in the reverse order of their pull-up. Relays shall be octal socket type with 120 VAC or 24 VDC coils. Contacts shall be rated at 3 A at 24/120 VAC with a full load electrical life of 100,000 operations and a mechanical life of 10,000,000 operations.

Relays that operate with a first-on, first-off control sequence shall not be allowed.

Macromatic (Triplexor Only), #ATP120A1 (120 VAC coil) or #APT024A1 (24 VDC coil) or equal.

4. Time delay relays

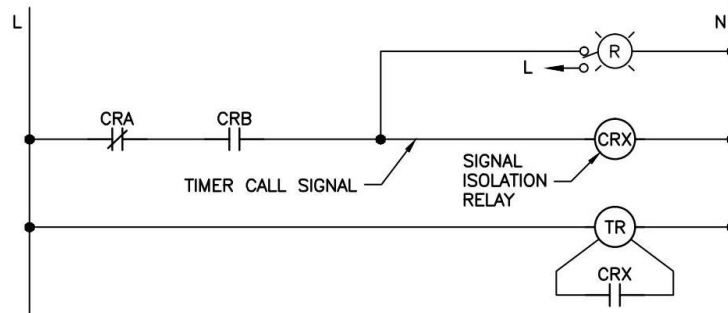
Time delay relays shall be electronic, programmable, multifunction type with a minimum of two Form C (DPDT) contacts rated at 10 A into resistive loads. Timers shall have a selectable timing range

from 0.05 seconds to 999 hours. The following features shall be provided on the front of the timer for easy and clear adjustability:

- a. Function selection (type of delay function);
- b. Time setting (3 digits);
- c. Timing range (seconds, minutes, hours);
- d. Table showing the selectable functions;
- e. LED indicator that indicates timing mode and time out condition.

On-delay timers (TDAE, Time Delay After Energization) shall be 8-pin octal socket style with 120 VAC or 24 VDC coils; Macromatic #TD-70222 and #TD-70228 respectively.

Off-delay timers (TDAD, Time Delay After De-energization) shall be 11-pin socket style with 120 VAC or 24 VDC coils, requiring an isolated trigger (see figure below); Macromatic #TD-71622 and #TD-71628, respectively.



5. PLC 24 VDC Output Buffer Relays

PLC 24 VDC output buffer relays shall be miniature DIN-rail DPDT type with silver-nickel alloy contacts rated at 8 amps @ 250 VAC/30 VDC (resistive load), 4 amps @ 250 VAC/30 VDC (inductive load), and 100,000 operations at full rated load with a dielectric strength between contacts of 1,000 VAC for 1 minute.

The relay coil shall be 24 VDC, with a mechanical life of 50 million operations and a dielectric strength between the coil and contacts of 5,000 VAC for 1 minute. Relays shall have a maximum pickup time of 15 milliseconds and release time of

10 milliseconds and a minimum drop voltage of 10 percent of the rated voltage.

Relays shall include a non-polarized LED coil indicator.

Relays shall include a DIN-rail mounting socket, 0.625-inch wide maximum with finger-safe screw terminals and replacement locking lever. DPDT relays and sockets shall be stackable at 0.625 inch.

Relays shall be IDEC RJ2S-CL-D24 or exact equal.
Sockets shall be IDEC SJ2S-07L or exact equal.

6. PLC 120 VAC - to - 24 VDC Input Buffer Relays

PLC 120 VAC input buffer relays shall be miniature DIN-rail DPDT type with silver-nickel alloy contacts rated at 8 amps @ 250 VAC/30 VDC (resistive load), 4 amps @ 250 VAC/30 VDC (inductive load), and 200,000 operations at full rated load with a dielectric strength between contacts of 1,000 VAC for 1 minute.

The relay coil shall be 120 VAC, with a mechanical life of 30 million operations and a dielectric strength between the coil and contacts of 5,000 VAC for 1 minute. Relays shall have a maximum pickup time of 15 milliseconds and release time of 10 milliseconds and a minimum drop voltage of 30 percent of the rated voltage.

Relays shall include a non-polarized LED coil indicator.

Relays shall include a DIN-rail mounting socket, 0.625-inch wide maximum with finger-safe screw terminals and replacement locking lever. DPDT relays and sockets shall be stackable at 0.625 inch.

Relays shall be IDEC RJ2S-CL-A120 or exact equal.
Sockets shall be IDEC SJ2S-07L or exact equal.

E. LEVEL INDICATOR/SETPOINT CONTROLLERS (LICs)

For processes using setpoint controllers for level control, such as wet wells and reservoirs, the following specifications shall apply.

1. 120 VAC or 24 VDC power (as shown on the Plans).

2. 4-20 mA or 0-10 VDC analog input (as shown on the Plans).
3. 16-point scaling for non-linear processes.
4. Four setpoint outputs, each with its own separate “SET” and “RESET” setoints.
5. Panel mount configuration.
6. LICs shall be Red Lion PAXP Process Input Panel Meters with PAXCDS Quad Setpoint Relay Output Card or equivalent.

F. THERMAL SETPOINT CONTROLLERS/TRANSMITTERS

1. Motor Winding Temperature Monitoring and Alarming Thermal Setpoint Controllers shall be:
 - a. 2-wire, 3-wire, and 4-wire Ni100 and Pt100 RTD compatible;
 - b. B, E J, K, N, R, S, T (ITS 90/IEC 584), L (DIN 43710) thermocouple compatible;
 - c. Provide a linearized 4-20 mA isolated output;
 - d. Provide an adjustable over- and under- temp Form A, 250 VAC, 500 VA (2 A) output contact;
 - e. Provide line monitoring for sensor wire-break and short circuit;
 - f. Capable of operating between 20 and 250 VAC input power;
 - g. Provide galvanic separation of input circuits, output circuits, and power supply;
 - h. Provide no more than 0.2 mA of sensor current;
 - i. Provide galvanic separation of input circuits, output circuits, and power supply;
 - j. Turck Interface Module, Ex-Temperature Measuring Amplifier, 1-Channle; Part Number IM34-12EX-RI or equal.

G. INTRINSICALLY SAFE BARRIERS

1. Intrinsically Safe Barriers, Analog (ISBAs)
 - a. ISBAs shall be single-channel, 4-20 mA input, 2-wire, 4-20 mA output, loop powered with an ungrounded field circuit; R. Stahl P/N 9002/13-280-110-001, no exceptions.
 - b. ISBAs shall provide electrical isolation between the input circuit, the output circuit, and the supply voltage.
 - c. ISBAs shall transfer 4-20 mA or 0-10 VDC input signals without attenuation (1:1 throughput).
2. Intrinsically Safe Barriers, Digital (ISBDs)
 - a. ISBDs shall be contact input, 2-channel, 2 x SPST, 2 Amp rated output (configurable N.O. or N.C.), universal supply voltage 20-250 VAC/20 – 125 VDC, UL-913 listed: Turck IM1-22Ex-R, PR Electronics 5202B2 or equivalent.
 - b. ISBDs shall provide electrical isolation between the input circuit, the output circuit, and the supply voltage.
 - c. ISBDs shall have programming switches to select if the output will operate in normally closed, normally open, or short circuit/wire break modes (fault detection mode). Disable the wire-break and short-circuit monitoring when using mechanical contacts as the input.
 - d. ISBDs shall have an LED on the front cover to indicate the switching status of the digital device.

H. ETHERNET SWITCHES

Ethernet switches shall be industrial grade, 10/100 MB, DIN-rail mounted type, 24 VDC powered, 8-port; N-Tron 300 series or equal.

Exceptions:

- *If the requirement shown on the Plans is greater than 8 ports, then provide the higher value.*
- *Non-DIN-rail acceptable if over 16 channels.*

I. AUTODIALERS

Autodialers shall be 8 channel, 8 phone number, with dial-out capability for power failure and low battery and shall include 20-hour internal backup batteries. The device shall operate at 12 VDC and include a 120 VAC to 12 VDC wall plug power supply.

Exception:

- *Provide 8 channel input or the number of channels as shown on the Plans, whichever is the greater.*

Antx Dialog Scout, or equal.

2.4 CONTROL PANEL ANCILLARY DEVICES

A. RECEPTACLES MOUNTED IN CONTROL PANELS

120 VAC power to convenience and device receptacle in control panels shall not be derived from the same panelboard circuit as that used for process control devices (PLC, flow meters, autodialers, DC power supplies, etc.).

1. Convenience Receptacles

Convenience receptacles in control panels are not dedicated and are intended for providing 120 VAC convenience power for non-motor-operated equipment.

Convenience receptacles shall be GFCI, 15 Amp, 125 VAC, duplex, white, in a DIN-rail mount, cast aluminum box. Stamped steel boxes shall not be used.

2. Device Receptacles

Device receptacles are dedicated for communication and control devices operating within the control panel on a continuous basis. These include devices with 120 VAC power packs like VPNs, Fiber-To-Voice Converters, Data-To-Voice Converters, and etc.

Device receptacles shall be non-GFCI, 15 Amp, 125 VAC, duplex, white, in a DIN-rail mount, cast aluminum box. Stamped steel boxes shall not be used.

On Communication Patch Panels, these receptacle circuits can be extended with surge- and load-protected power strips.

3. Combination Port

The combination port shall consist of a simplex 120 VAC receptacle and a Category 5e ethernet port mounted on a single bulkhead.

The simplex receptacle shall have a placard stating “For Computer Use Only” along with the current rating. The current rating shall not be less than 3 A. If the receptacle rating is less than 15 A, the combination port shall have an integrated circuit breaker, operable without opening the enclosure, allowing the receptacle to be wired to an ordinary 15 A circuit.

The Category 5e ethernet port shall be a female RJ-45 connector, allowing an operator to connect a computer to the PLC over ethernet without opening the enclosure.

The bulkhead shall be a listed assembly. The bulkhead shall be installed in a manner that preserves the environmental rating of the enclosure. The bulkhead shall have a hinged cover that protects the combination port when not in use.

B. PANEL LIGHTING

For all panels so designated on the Plans, provide an LED lighting package, under cabinet style, hardwired, 120 VAC, with integral door-activated ON/OFF switch.

120 VAC power to the panel light shall not be derived from the same Panelboard circuit as that used for process control devices (PLC, flow meters, autodialers, DC power supplies, etc.).

C. PANEL HEATER

Provide a panel heater with thermostat in each outdoor control panel and all panels so designated on the Plans. Each heater shall include a DIN-rail mounted disconnect breaker and associated feedthrough and grounding terminals for connection to external 120 VAC line, neutral, and ground conductors. The heater and thermostat shall be prewired to these terminals and breaker.

The wattages shown below are minimum values. The Contractor shall size the panel heaters based on enclosure size, internal load heat generation, minimum operating temperature of devices in the enclosures, and minimum ambient temperature. Contractor shall include panel heating calculations with control panel submittals.

For panels with a front surface area greater than 11 square feet, provide a touch-safe, 550 watt minimum, 120 VAC panel heater with integral thermostat.

For panels with a front surface area less than 11 square feet, provide a semiconductor type, 30 watt minimum, 120 VAC, DIN-rail panel heater. Provide a N.C., DIN-rail heater thermostat with 15 Amp contacts at 120 VAC.

120 VAC power to panel heaters shall not be derived from the same Panelboard circuit as that used for process control devices (PLC, flow meters, autodialers, DC power supplies, etc.).

D. PANEL AIR CONDITIONING UNITS

Provide control panel air conditioners where specifically called out on the Plans. Size the AC unit to maintain an operating temperature below the specification of that device within the panel with the lowest “maximum allowed temperature.” Present calculations to Engineering during Submittal.

E. PANEL COOLING FANS

Provide a panel cooling system in enclosures that contain motor starters, drives, PLCs, RTUs, and other electronic devices that can generate heat and have maximum operating temperature limits unless specifically shown otherwise in the Plans. The panel cooling system shall include one or more fans with a thermostat as a minimum. The cooling system shall be sufficiently sized to maintain an internal enclosure temperature below the maximum operating temperature of all internal devices.

Provide a thermostat for cooling, N.O. contact, adjustable setpoint range 32 to 140 degrees F, 15 Amp-rated contact at 120 VAC.

Cooling fans shall be configured to exhaust air. Vents shall be provided for supply air. Layout fans and vents in such a manner as to:

1. Maximize cooling of critical components;

2. Minimize air flow restriction;
3. Eliminate entry of water or dust particles into the enclosure.

Provide vent covers over fan and vent openings to eliminate rain and moderate washdown for all outdoor panels and all panels so designated on the Plans

Provide a “washdown filter” fan set, capable of eliminating sprayed water entry, stainless steel, 120 VAC, 310 CFM, 3.8 Amps max., 18" x 10" x 5".

120 VAC power to panel fans shall not be derived from the same panelboard circuit as that used for process control devices (PLC, flow meters, autodialers, DC power supplies, etc.).

F. TERMINAL BLOCKS

1. For Power Circuits > 30 Amps

Terminations for power circuits greater than 150 V to ground or greater than 30 A shall be made using 600 VAC, listed, screw type, Power Distribution Blocks.

2. For Non-Fused Control, Instrumentation, and Power Circuits < 30 VDC, < 150 VAC, and <= 30 Amps

Provide standard feed-through DIN-rail type IEC terminal blocks, single circuit, screw terminal type, #22 - #10 AWG, rated 600 V AC/DC at 30 A, white or grey; Allen Bradley Bulletin 1492-J4 series or equal.

Exceptions:

- *For equipment/chassis grounded circuits*

Provide DIN-rail type IEC grounding blocks, single circuit, screw terminal type, #22 - #10 AWG, rated 600 V AC/DC at 30 A, green/yellow in color; Allen Bradley Bulletin 1492- WG6 or equal. These ground blocks shall be inherently connected to the din rail.

- *For instrumentation cable shield terminations (reference Section 3.1.E)*

Provide standard feed-through DIN-rail type IEC terminal blocks, single circuit, screw terminal type, #22 - #10 AWG, rated 600 V AC/DC at 30 A, blue; Allen Bradley Bulletin 1492-J4-B or equal.

5. Terminals used for digital and analog I/O field connections shall be grouped as shown in Section 3.1.E, FABRICATION, FIELD CONNECTIONS TO PLC I/O.

G. PANEL WIRING PRODUCTS

1. Power Circuit Wiring; Reference Specification 16120.
2. Control Circuit Wiring; Reference Specification 16120.
3. Analog PLC I/O Wiring

Signal cables connected completely inside control panels between analog input and output field terminal groupings and their associated PLC analog cards shall be #22 AWG, stranded, tinned copper, twisted pair, 300 V, 100 percent overall foil shielded cable with #22 AWG tinned copper drain wire; Belden #8451 or equal.

2.5 CONTROL PANEL 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 1/2 inch for instrument description and 1/4-inch height for instrument tag number.
4. Provide each panel with a 2-inch by 10-inch (minimum) nameplate with 1-inch-high lettering with panel identification.
5. Abbreviations are not permitted unless approved by the Owner or specifically shown on the nameplates, schedules, or plans.
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 applications in such a manner as to avoid nameplate buckling or distortion due to use of excessive adhesive or over tightening of screws.

PART 3 INSTALLATION

3.1 FABRICATION

A. GENERAL

1. Control panels are factory or shop fabricated units completely assembled, wired, and tested before shipment to the job site.
2. Panel construction, in general, meets JIC EMP-1 standards and applicable NEMA and IEEE standards.

Exception:

- *Where open penetrations are required, such as for fans and vents, the NEMA rating of the panel may be modified to meet the intent of the design and fit the environment of the application. Verify the change of a panel's NEMA rating with the Engineer.*
3. The panels shall be constructed in accordance with Article 409 of the NEC and electrical testing laboratory standards and shall be so labeled (the standards of a recognized electrical testing laboratory).
 4. Size panels for enclosed equipment and available space for mounting of panel or as shown on the Plans.
 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. Paint shall be suitable for field touch-up. Spare paint (1 quart) shall be provided for touch-up purposes.

Exceptions:

- *If the panel is to be used in eastern Washington, then the final outer coating shall be high gloss white.*
- *Unless shown otherwise in the Plans stainless steel enclosures shall not be painted.*

6. Panel material, penetrations, and etc. shall be verified for proper operation in their intended locations. Issues and concerns shall be brought to the attention of the Engineer prior to fabrication within or on the panel.

B. FREE-STANDING PANELS

1. Welded construction
2. Completely enclosed, self-supporting, and gasketed dust-tight.
3. Seams and corners welded and ground smooth.
4. Furnish doors with keyed alike locking handles and three point catch.
5. Provide each panel with lifting eyebolts. Furnish stainless steel base channels.
6. Slotted bolt holes in base, 1-1/2 long for field adjustment.

C. COMPONENT INSTALLATION

1. Minimize welding to panel fronts and avoid distortion of panel metal.
2. Reinforce around areas of the enclosure weakened by openings or mounting of heavy equipment/components.
3. Accurately and cleanly cut or nibble cutouts, 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.
4. Provide minimum 1-5/8-inches spacing between horizontal rows of externally mounted components; 1-1/2 inches minimum between vertical columns of components.
5. 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, etc., shall be mounted in accordance with the sequence of operation from left to right and top to bottom.

6. 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 1 inch below.
7. Components mounted in the interior shall be fastened to an interior subpanel using machine screws plus adhesive to insure vibration-free attachment.
8. 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.
9. AC UPS systems and associated batteries shall be mounted on a shelf specifically sized and braced for the UPS system. This rack shall assure that the UPS system is not resting on the bottom of the Control Panel and that no part of the UPS system blocks, or in any other way interferes with devices, terminals, or wireways that are not specifically a part of the UPS system. The shelf shall have a raised lip around all sides that are not in contact with a wall. The bottom of the shelf shall be at least 4 inches above the bottom of the enclosure (this provides a free flow of cables and conductors from conduits entering the bottom of the panel). Straps shall be provided to secure the UPS to the shelf.

If insufficient room is available on the panel's backplane, then mount the shelf to the inside of the door. When mounted on the door, secure all cables to the door in such a manner that assures:

- a. Highly reliable secured connections to the UPS (not affected by movement of the door),
 - b. Free and unencumbered door movement,
 - c. Door movement that does not stress the cables.
10. Open batteries provided to support DC UPS systems shall be mounted on 316L stainless steel shelves and provided with non-conducting bracing straps to firmly hold the battery in place. The shelves shall have a raised lip around all sides that are not in contact with a wall. The bottom of the shelf shall be at least 4 inches above the bottom of the enclosure.

Batteries provided with manufacturer's mounting systems do not require the additional stainless steel shelving.

D. PANEL WIRING METHODS

1. Provide panel wiring sizes and colors per Specification 16120.
2. Provide PLC analog and digital input and output circuit field terminations and wiring methods per Section 3.1.E.
3. Field wiring terminations to control panel terminal strips shall be connected as shown on the Plans. Cable shields or "drain" wires shall be terminated as per manufacturer's recommendations.
4. Provide a chassis-connected equipment ground bus at the bottom of PLC control panels.
5. Provide an isolated ground bus, dedicated solely for analog shield connections, adjacent to the equipment ground bus. Provide a separate and dedicated #10 AWG minimum green-insulated ground wire from the Panelboard ground bus to the isolated ground bus.
6. Provide raceways for panel wiring.
 - a. Size raceways per the requirements of NEC.
 - b. Provide panel wireways between each row of components, and adjacent to each terminal strip.
 - c. Wireways are a minimum of 1-inch wide and 3-inches deep with removable snap-on covers and perforated walls for easy wire entrance. Wireways shall be constructed of non-metallic materials with a voltage insulation in excess of the maximum voltage carried therein Panduit type LG, Panel Channel or equal
7. Run wires neatly in wiring duct tied and bundled with tie wraps or similar materials.
8. Provide wire bending space per NEMA ICS 6.
9. Label wiring within the panel with wire numbers using the same number on both ends of the wire. Identify each wire termination,

including long jumpers, with wire markers. Arrange wire labels to permit reading of identification when installed.

10. Connect wiring internal to the panel to one side, leaving the opposite side for field terminations. Connect no more than two wires to any one control terminal point.
11. Arrange wiring inside the panel to separate instrumentation cables, conductors, and terminals at least 12 inches from 120 VAC power and control circuits.
12. Connect electrical equipment grounds to the chassis grounding bus.
13. Provide necessary power supplies for control equipment.

E. WIRE TERMINATION METHODS

1. Power conductors terminated on Power Distribution Blocks shall be covered with the block manufacturer's transparent cover and a caution sticker stating the voltage and available bolted fault current.
2. Terminate one end of all instrumentation cable shields to blue isolated-ground terminals (reference Section 2.4.E).
3. Provide fused terminals as shown on the Plans or defined herein. Reference Section 2.2 for materials
4. Terminals used for 4-20 mA analog input and output circuits shall be grouped as shown herein. This grouping shall be provided for each analog input and output connected to a PLC, whether assigned or unassigned (spare).
5. Provide terminal strips for the termination of panel wiring not directly connected to panel mounted devices.
6. Terminals shall facilitate wire sizes as follows:
 - a. 120 VAC applications: Wire size 12 AWG and smaller.
 - b. Other: Wire size 14 AWG and smaller.
7. Tag each I/O terminal to indicate tag number of the connected device or wire.

8. Provide 20 percent excess terminals (minimum) for future expansion.
9. Provide a minimum of 1.5 inches between terminal strips and wireways or between terminal strips.

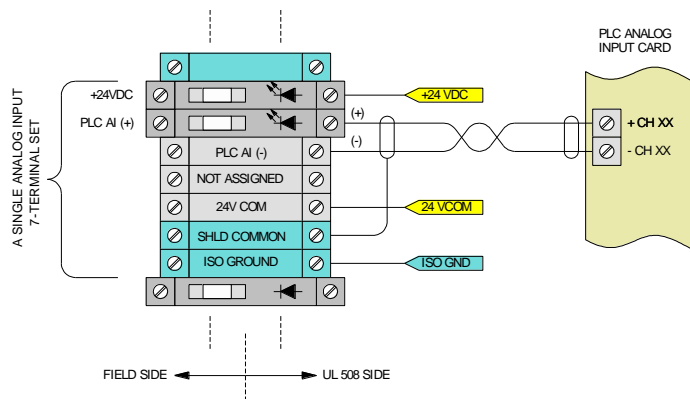
F. FIELD CONNECTIONS TO PLC I/O

1. Analog Input, Termination and Connectivity

Each 4-20 mA PLC analog input shall be connected to a 7-terminal grouping as shown below and as detailed on the Analog Loop Diagrams on the Plans whether the input channel is assigned or unassigned (spare) and whether the input is single-ended, differential, or isolated. No chassis-grounded terminals shall be used. Reference table below.

7-Terminal Analog Input Grouping, Terminal Assignments

Internal Panel Connections	Clarification	Terminal Type and Color
+24VDC	+ 24 VDC Power	Fused, Black
PLC AI (+)	PLC Analog Input, +	Fused, Black
PLC AI (-)	PLC Analog Input, -	Feedthrough, Gray
NOT ASSIGNED	2-Device Connection	Feedthrough, Gray
24VCOM	24 V Common	Feedthrough, Gray
SHLD COMMON	Shield Common	Feedthrough, Blue
ISO GROUND	Isolated Ground	Feedthrough, Blue



All connections on the UL 508 side are the same, regardless of the type of field connection.

Bundle all analog input terminal groups in the same sequence as the analog input cards and channels.

Maintain a minimum of 12 inches between analog terminal groups and AC power circuits.

The shields shall be connected at the terminal block-end only. Shields shall not be connected at the PLC cards.

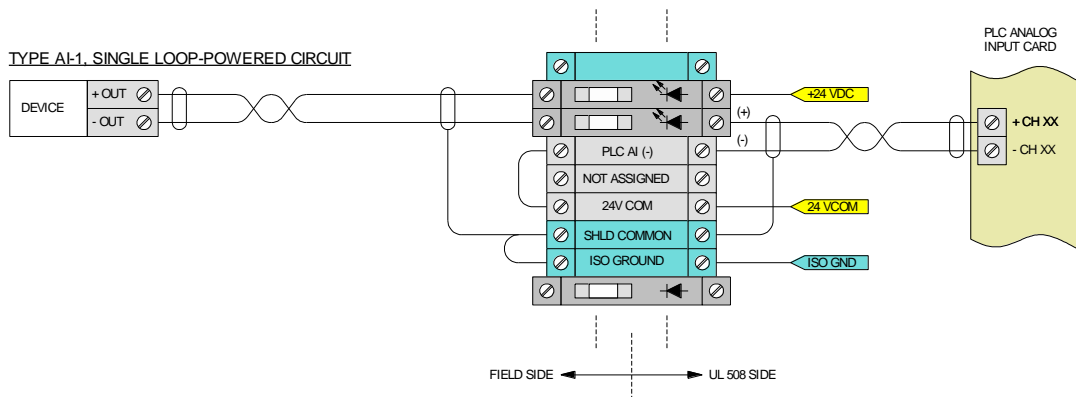
No additional 24 VDC fusing is to be provided.

For cable type between terminal groupings and analog input PLC cards, reference Section 2.4.F.

2. Analog Input, 7-Terminal Connection Methods

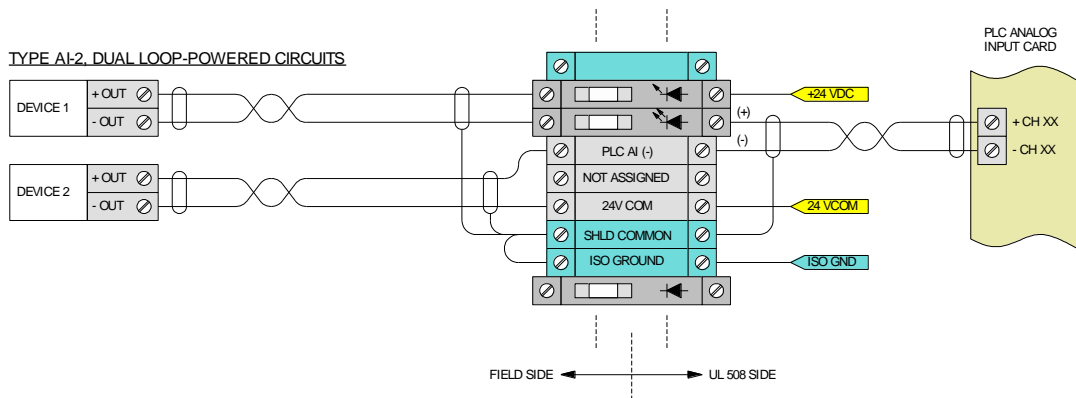
- a. Field Connection **TYPE AI-1**, connection to a single loop-powered field device

The Figure below shows the method of connecting a PLC analog input to a single loop-powered field device using a 7-terminal standard analog input terminal group.



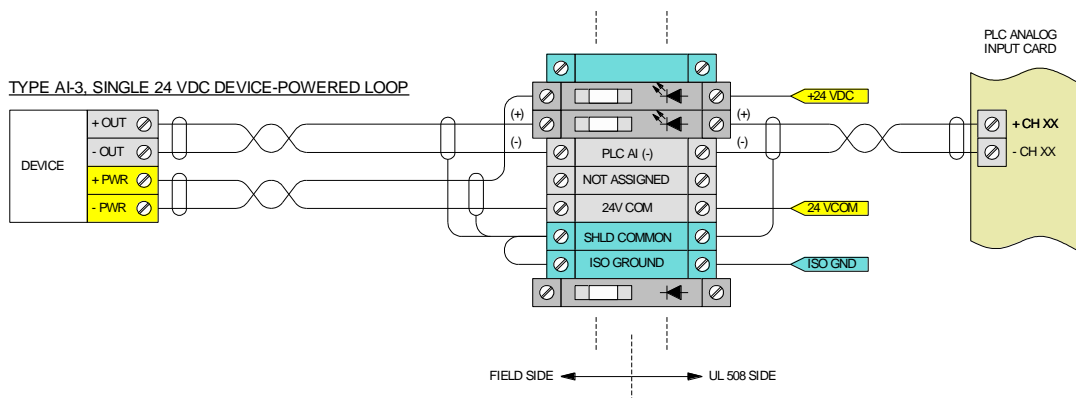
- b. Field Connection **TYPE AI-2**, connection to two loop-powered field devices

The Figure below shows the method of connecting a PLC analog input to two loop-powered field devices using a 7-terminal standard analog input terminal group.



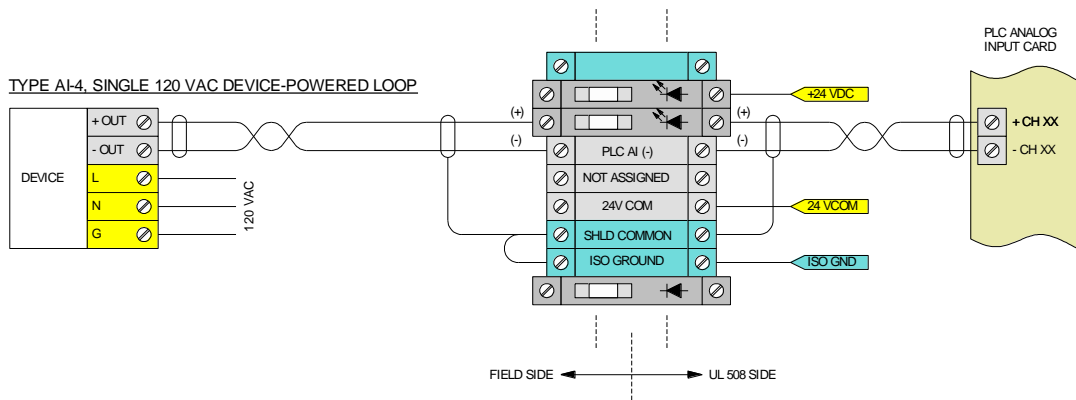
c. Field Connection **TYPE AI-3**, connection to a single 24 VDC device-powered field device

The Figure below shows the method of connecting a PLC analog input to a single 24 VDC device-powered field device using a 7-terminal standard analog input terminal group. Device power is provided by the control system power.



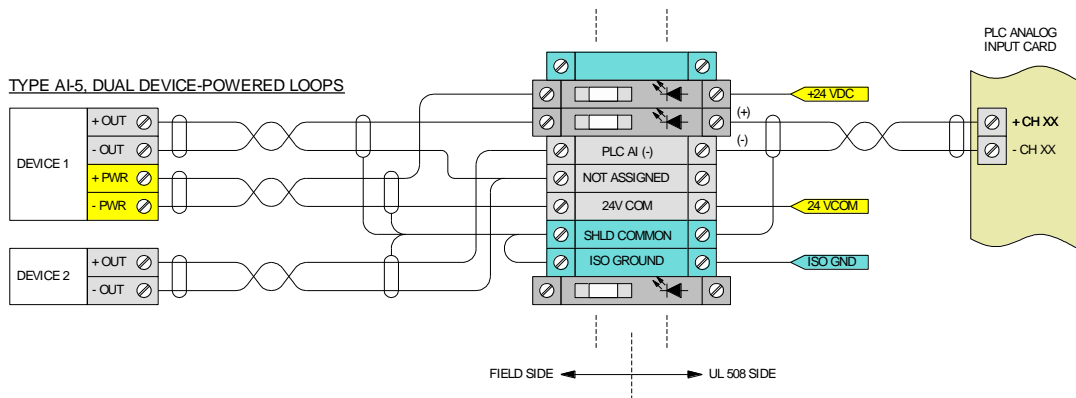
d. Field Connection **TYPE AI-4**, connection to a single 120 VAC device-powered field device

The Figure below shows the method of connecting a PLC analog input to a single 120 VAC device-powered field device using a 7-terminal standard analog input terminal group.



- e. Field Connection **TYPE AI-5**, connection to a set of 24 VDC device-powered and loop-powered field devices

The Figure below shows the method of connecting a PLC analog input to two field devices, with at least one requiring 24 VDC device power using a 7-terminal standard analog input terminal group. Device power is provided by the control system power.

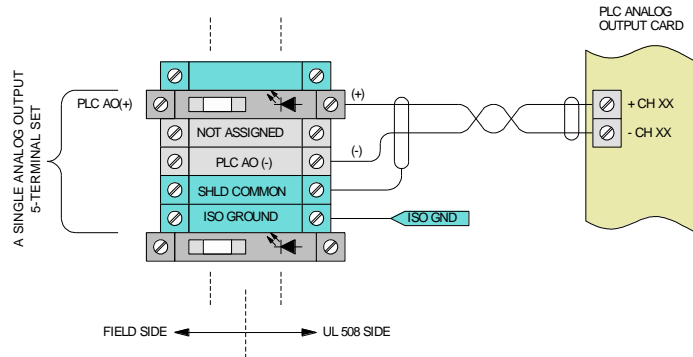


3. Analog Output, Termination and Connectivity

Each 4-20 mA PLC analog output channel shall be connected to a 5-terminal grouping as shown below and as detailed on the Plans whether the input channel is assigned or unassigned and whether the output is isolated or not. No chassis-grounded terminals shall be used. Reference table below.

5-Terminal Analog Input Grouping, Terminal Assignments

Internal Panel Connections	Clarification	Terminal Type and Color
PLC AO(+)	PLC Analog Output, +	Fused, Black
NOT ASSIGNED	2-Device Connection	Feedthrough, Gray
PLC AO(-)	PLC Analog Output, -	Feedthrough, Gray
SHLD COMMON	Shield Common	Feedthrough, Blue
ISO GROUND	Isolated Ground	Feedthrough, Blue



All connections on the UL 508 side are the same, regardless of the type of field connection.

Bundle all analog output terminal groups in the same sequence as the analog output cards and channels.

Maintain a minimum of 12 inches between analog terminal groups and AC power circuits.

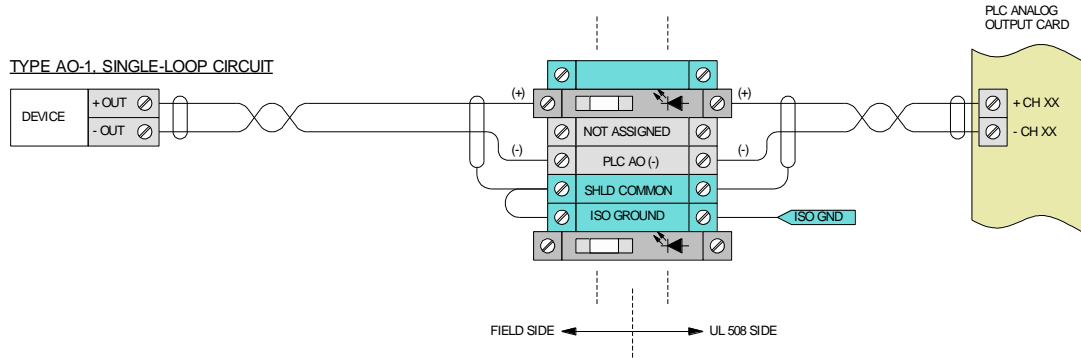
The shields shall be connected at the terminal block-end only. Shields shall not be connected at the PLC cards.

No additional 24 VDC fusing is to be provided.

For cable type between terminal groupings and analog input PLC cards, reference Section 2.4.F.

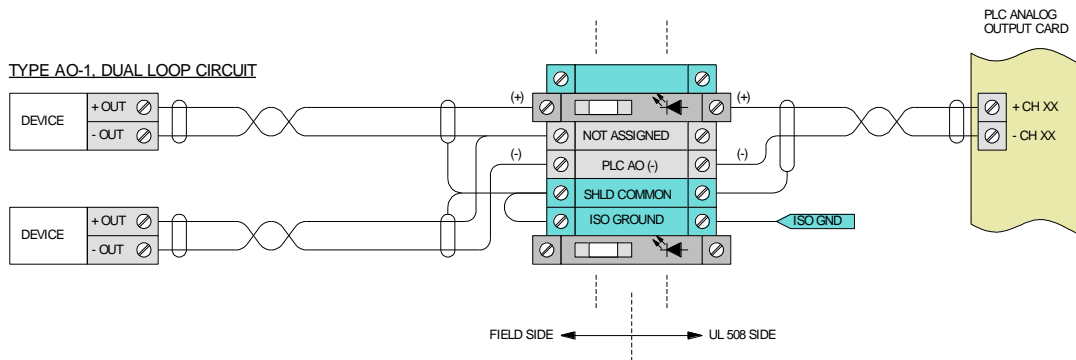
4. Analog Output, 5-Terminal Connection Methods
 - a. Field Connection **TYPE AO-1**, connection to a single field device

The Figure below shows the method of connecting a PLC analog output to a single field device using a 5-terminal standard analog output terminal group.



b. Field Connection **TYPE AO-2**, connection to two field devices

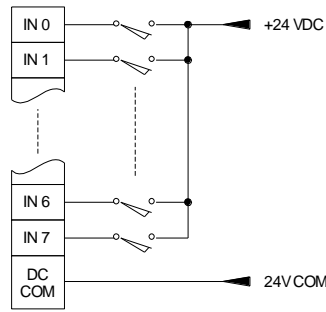
The Figure below shows the method of connecting a PLC analog output to two field devices using a 5-terminal standard analog output terminal group. These devices can be loop-powered or device powered.



5. Digital Input, Termination and Connectivity

a. Digital Input Type

All digital inputs shall be the “sinking” type as shown below. Reference Specification Section 13450, Programmable Logic Controller (PLC) Hardware.



1/2 OF 24 VDC, 16 CHANNEL PLC
DIGITAL SINKING INPUT CIRCUIT

b. Digital Input Fusing to Field Circuits

Provide fusing for each field-connected digital input. A single fuse shall be used for a group of field inputs from a common remote panel providing that the inputs are connected to the same input card. A common fuse shall not be used for separate cards.

Separate fuses shall be provided for field inputs that are not terminated in a common remote panel.

Provide a separate fuse for each set of 4 unassigned (spare) Digital Inputs.

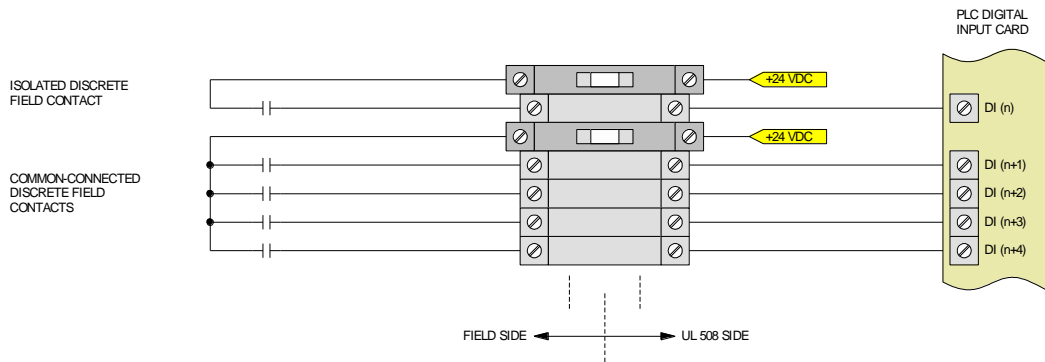
Fuses shall be 0.5 Amp.

Provide a separate gray feedthrough terminal for each digital input channel whether the input channel is assigned or unassigned.

c. Digital Input Connection Methods

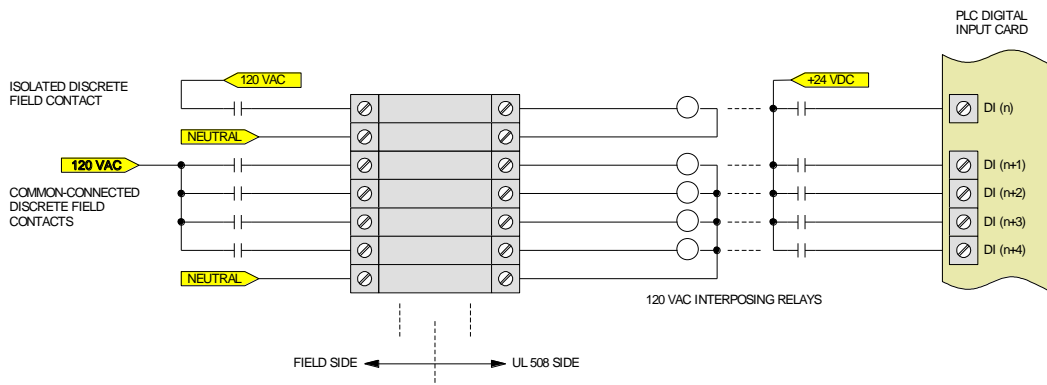
i. Connections to “Dry” Field Contacts

Discrete input field devices with dry Form A or Form B contacts sharing a common cabinet or piece of equipment may be combined into a group sharing a single +24 VDC fused common as shown below.



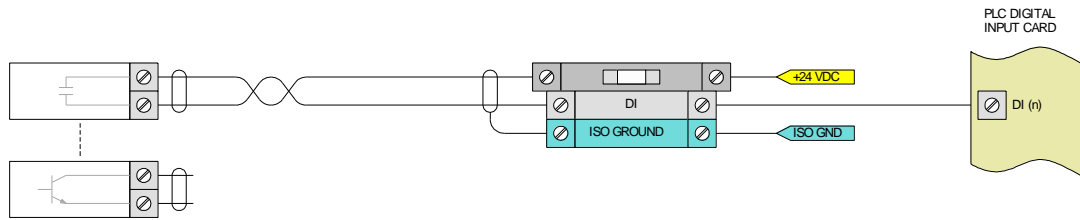
ii. Connections to “Hot” (wet) 120 VAC Field Circuits

Digital inputs derived from 120 VAC "hot" circuits shall be buffered through interposing relays inside the PLC control panel prior to connection to the 24 VDC Digital Input PLC cards in a manner shown in the Figure below. Reference “PLC 120 VAC - to - 24 VDC Input Buffer Relays” in Section 2.2 for relay product type.



iii. Digital Pulse Inputs

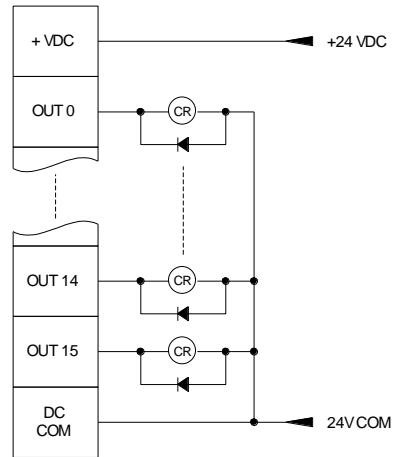
Digital pulse inputs shall be either dry Form A or Form B contacts or active open-collector circuits as shown in the Figure below. The +24 VDC power shall be provided by the 24 VDC control system power and shall be separately fused.



6. DIGITAL OUTPUT, Termination and Connectivity

a. Digital Output Type

All digital outputs shall be the “sourcing” type as shown below. Reference Specification 13450, Programmable Logic Controller (PLC) Hardware.



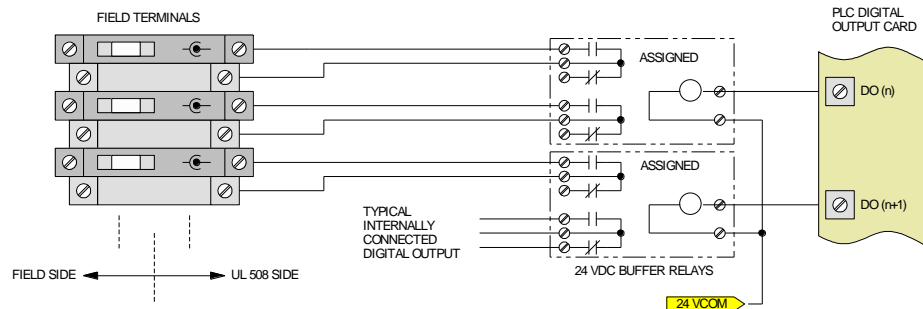
24 VDC, 16 CHANNEL PLC
DIGITAL SOURCING OUTPUT CIRCUIT

b. Digital Output Buffer Relays

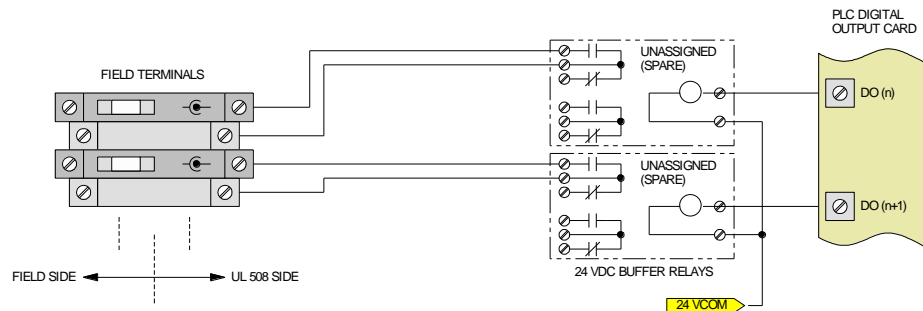
All 24 VDC digital outputs, even if unassigned (spare), shall be buffered through a DPDT (minimum) interposing relay prior to being connected to other internal circuits or field terminals. 4PDT relays shall be provided where shown on wiring diagrams. Reference “PLC 24 VDC Output Buffer Relays” in Part 2 for product type.

Internally connected buffered outputs shall not be fused.

Assigned digital outputs shall be assigned to single or double fused output terminal pairs as shown in the Figure below.



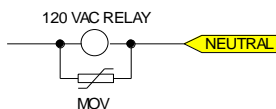
All unassigned digital outputs shall be buffered to a single fused output terminal pair as shown in the Figure below.



G. RELAY COIL SURGE SUPPRESSION

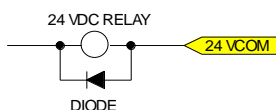
1. 120 VAC Coil Surge Suppression

All 120 VAC coils shall be paralleled by a Metal Oxide Varistor (MOV) type surge suppressor as shown in the Figure below. The suppressor shall be connected directly across the relay socket coil terminals with short wire leads.



2. 24 VDC Coil Surge Suppression

All 24 VDC coils shall be paralleled by a reverse-connected shunt diode as shown in the Figure below. The diode shall be connected directly across the relay socket coil terminals with short wire leads. The diode shall be rated at 1A, 100 PIV minimum.



3.2 SOURCE QUALITY CONTROL

- A. Submit a shop test plan indicating how the test will be conducted, and how the system will be verified.
- B. Revise all plans upon completion of the work to show the “as shipped” condition of the panel.
- C. Allow for the owner and Engineer to witness the shop test. Provide a minimum of 15-days notice prior to the test.
- D. Provide a shop test after factory completion and prior to shipment.
 - 1. Test Documentation
 - a. Provide a testing procedure and submit to the Engineer at least 1 week prior to the shop test.
 - b. Document all required corrections, even those that may be remedied during the shop test.
 - c. Issue a copy of the test procedures and necessary corrections to the General Contractor and the Engineer.
 - d. Make all necessary corrections before shipping any panels, equipment, or devices to the job site.
 - e. Issue a final signed document verifying that each correction has been made.
 - 2. PLC Control Test
 - a. Conduct a burn-in period (minimum of 2 days) where the system is operated continuously and checked for proper operation.
 - b. Utilize simulated I/Os to verify proper operation. Demonstrate the operation of each digital and analog I/O point.
 - c. Demonstrate complete connectivity and data transfer over the process control network. Verify the operation of all motor starters and remote devices monitored and controlled over the network.

- d. Provide a computer and the software required for testing such that the owner may view the simulation of operator entries of field parameters such as set points and alarm values during the test.
- 3. Relay and Process Controller Test
 - a. Demonstrate the complete operation of the relay logic, backup logic, process controllers, and etc.
- 4. Motor Starter Test
 - a. Demonstrate the complete operation of all motor starters. Connect a portable motor to each starter and operate the motor in HAND, OFF, and AUTO modes. Demonstrate the proper operation of all motor safety interlocks.
 - b. Preprogram all motor starter Human Interface Modules (HIMs) for compliance with motor manufacturer's protection criteria and compliance with the design engineer's control requirements.
- 5. Other Tests
 - a. Provide normal operating voltage to all equipment. Demonstrate the operation of all equipment while under power.
 - b. The entire assembled panel shall be tested to be free from grounds and shorts.
 - c. Controllers, circuits and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped.

3.3 INSTALLATION

- A. Install freestanding panels on concrete housekeeping pads.
- B. Anchor panels rigidly in place with approved anchorage devices. If mounting details are shown on the Plans, then these methods shall be used.

***** END OF SECTION *****

SECTION 16941

ASSORTED ELECTRICAL DEVICES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes devices which are not part of other systems or large enough to have a dedicated specification.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
Division 16	Electrical
16050	Basic Electrical Materials and Methods
16420	Motor Controllers
16442	Control Centers
16940	Control Panels

1.3 REFERENCES

<u>Reference</u>	<u>Title</u>
NEMA	National Electrical Manufacturers Association
ICS-1	General Standards for Industrial Control and Systems
ICS-6	Enclosures for Industrial Controls and Systems
Publication No. 250	Enclosures for Electrical Equipment (1000 V maximum)
NFPA	National Fire Protection Association
NEC	National Electric Code
JIC-EMP-1	Joint Industrial Council

1.4 SYSTEM DESCRIPTION

A. CONTROL PANELS

1. Reference Section 16050, 1.3, Definitions.
2. Reference Section 16940.

B. CONTROL CENTERS

1. Reference Section 16442.

C. MOTOR CONTROLLERS

1. Reference Section 16420.
2. Reference Section 16940.

1.5 SUBMITTALS

A. DEVICES

1. Submit per the requirements of Section 01300 and Section 16050.

B. OPERATION AND MAINTENANCE MANUALS

1. See Section 01300 and Section 16050.
2. Provide manufacturer's operating and maintenance manuals for each device or item provided.

1.6 QUALITY ASSURANCE

- A. See Section 16050, 1.7, Quality Assurance.

PART 2 PRODUCTS

2.1 COMPONENTS

A. SMOKE/HEAT DETECTORS

Smoke detectors shall operate on the principal of photoelectric detection. The smoke detector shall also provide a self-restoring integral isolated heat sensor set to alarm at 135 °F fixed temperature. The smoke detector shall be provided with a test button and contain an internal 90 dBA horn (at 10 feet) which sounds when the detector alarms. The smoke detector shall have the provision of reverse polarity protection. The smoke detector shall be 4-wire 24 VDC powered with a form C dry contact alarm and a non-latching auto reset feature. Wire the contact to be open when in the alarm condition, closed under normal conditions.

The smoke detector shall mount to a 2" x 3" switch box or 4-inch octagon junction box using a standard bracket that does not have to be purchased separately. The smoke detector shall be listed for wall or ceiling mount. The smoke detector shall be UL 268 listed and compliant with NFPA 72. GE Security model 541NCSRXT or equal.

B. CARBON MONOXIDE DETECTORS

Carbon monoxide detectors shall be provided with a test button and contain an internal horn which emits an intermittent tone when the detector alarms. The detector shall be 4-wire, 24 VDC powered, with a form C dry contact alarm. Alarm shall be able to be wired normally closed such that it alarms upon loss of power, CO sensor alarm, and end of life. The alarms shall automatically reset. The detector shall be UL listed and compliant with NFPA 720. Edwards Signaling model 250-CO or equal.

C. PHOTO CELLS

Photo cells shall be UL listed, 3 wire, with adjustable light shield, rated for the same voltage as the lighting fixtures shown in the Plans. Photocell shall have stem and swivel mount and be rated for operation between -40 degrees C and 70 degrees C. The output shall be rated at 20 A. Intermatic K4200 series or equal.

D. INTRUSION SWITCHES

Reference electrical Plans and Details.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all components per manufacturer's recommendations or as show on the Plans, whichever is the more stringent.

3.2 DEMONSTRATION

Demonstrate to the Owner that the electrical installation is working by operating the electrical component(s). Demonstration may be combined with demonstration of other equipment and systems, such as a control panel with an alarm beacon.

3.3 CLEANING

Clean dirt and debris from all surfaces.

***** END OF SECTION *****

PART 6
WAGE RATES

State of Washington
 Department of Labor & Industries
 Prevailing Wage Section - Telephone 360-902-5335
 PO Box 44540, Olympia, WA 98504-4540

Washington State Prevailing Wage

The PREVAILING WAGES listed here include both the hourly wage rate and the hourly rate of fringe benefits. On public works projects, worker's wage and benefit rates must add to not less than this total. A brief description of overtime calculation requirements are provided on the Benefit Code Key.

Journey Level Prevailing Wage Rates for the Effective Date: 07/02/2024

<u>County</u>	<u>Trade</u>	<u>Job Classification</u>	<u>Wage</u>	<u>Holiday</u>	<u>Overtime</u>	<u>Note</u>	<u>*Risk Class</u>
Mason	Asbestos Abatement Workers	Journey Level	\$59.07	5D	1H		View
Mason	Boilermakers	Journey Level	\$74.29	5N	1C		View
Mason	Brick Mason	Journey Level	\$69.07	7E	1N		View
Mason	Brick Mason	Pointer-Caulker-Cleaner	\$69.07	7E	1N		View
Mason	Building Service Employees	Janitor	\$16.28		1		View
Mason	Building Service Employees	Shampooer	\$16.28		1		View
Mason	Building Service Employees	Waxer	\$16.28		1		View
Mason	Building Service Employees	Window Cleaner	\$16.28		1		View
Mason	Cabinet Makers (In Shop)	Journey Level	\$16.28		1		View
Mason	Carpenters	Acoustical Worker	\$74.96	15J	4C		View
Mason	Carpenters	Bridge, Dock And Wharf Carpenters	\$74.96	15J	4C		View
Mason	Carpenters	Floor Layer & Floor Finisher	\$74.96	15J	4C		View
Mason	Carpenters	Journey Level	\$74.96	15J	4C		View
Mason	Carpenters	Scaffold Erector	\$74.96	15J	4C		View
Mason	Cement Masons	Application of all Composition Mastic	\$72.87	15J	4U		View
Mason	Cement Masons	Application of all Epoxy Material	\$72.37	15J	4U		View
Mason	Cement Masons	Application of all Plastic Material	\$72.87	15J	4U		View
Mason	Cement Masons	Application of Sealing Compound	\$72.37	15J	4U		View
Mason	Cement Masons	Application of Underlayment	\$72.87	15J	4U		View
Mason	Cement Masons	Building General	\$72.37	15J	4U		View
Mason	Cement Masons	Composition or Kalman Floors	\$72.87	15J	4U		View
Mason	Cement Masons	Concrete Paving	\$72.37	15J	4U		View
Mason	Cement Masons	Curb & Gutter Machine	\$72.87	15J	4U		View
Mason	Cement Masons	Curb & Gutter, Sidewalks	\$72.37	15J	4U		View
Mason	Cement Masons	Curing Concrete	\$72.37	15J	4U		View
Mason	Cement Masons	Finish Colored Concrete	\$72.87	15J	4U		View
Mason	Cement Masons	Floor Grinding	\$72.87	15J	4U		View

Mason	Cement Masons	Floor Grinding/Polisher	\$72.37	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Green Concrete Saw, self-powered	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Grouting of all Plates	\$72.37	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Grouting of all Tilt-up Panels	\$72.37	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Gunite Nozzleman	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Hand Powered Grinder	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Journey Level	\$72.37	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Patching Concrete	\$72.37	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Pneumatic Power Tools	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Power Chipping & Brushing	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Sand Blasting Architectural Finish	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Screed & Rodding Machine	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Spackling or Skim Coat Concrete	\$72.37	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Troweling Machine Operator	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Troweling Machine Operator on Colored Slabs	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Cement Masons	Tunnel Workers	\$72.87	<u>15J</u>	<u>4U</u>		View
Mason	Divers & Tenders	Bell/Vehicle or Submersible Operator (Not Under Pressure)	\$129.71	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Dive Supervisor/Master	\$93.94	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Diver	\$129.71	<u>15J</u>	<u>4C</u>	<u>8V</u>	View
Mason	Divers & Tenders	Diver On Standby	\$88.94	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Diver Tender	\$80.82	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 0-30.00 PSI	\$93.26	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 30.01 - 44.00 PSI	\$98.26	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 44.01 - 54.00 PSI	\$102.26	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 54.01 - 60.00 PSI	\$107.26	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 60.01 - 64.00 PSI	\$109.76	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 64.01 - 68.00 PSI	\$114.76	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 68.01 - 70.00 PSI	\$116.76	<u>15J</u>	<u>4C</u>		View
Mason	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 70.01 - 72.00 PSI	\$118.76	<u>15J</u>	<u>4C</u>		View

Mason	Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 72.01 - 74.00 PSI	\$120.76	15J	4C		View
Mason	Divers & Tenders	Manifold Operator	\$80.82	15J	4C		View
Mason	Divers & Tenders	Manifold Operator Mixed Gas	\$85.82	15J	4C		View
Mason	Divers & Tenders	Remote Operated Vehicle Operator/Technician	\$80.82	15J	4C		View
Mason	Divers & Tenders	Remote Operated Vehicle Tender	\$75.41	15J	4C		View
Mason	Dredge Workers	Assistant Engineer	\$79.62	5D	3F		View
Mason	Dredge Workers	Assistant Mate (Deckhand)	\$79.01	5D	3F		View
Mason	Dredge Workers	Boatmen	\$79.62	5D	3F		View
Mason	Dredge Workers	Engineer Welder	\$81.15	5D	3F		View
Mason	Dredge Workers	Leverman, Hydraulic	\$82.77	5D	3F		View
Mason	Dredge Workers	Mates	\$79.62	5D	3F		View
Mason	Dredge Workers	Oiler	\$79.01	5D	3F		View
Mason	Drywall Applicator	Journey Level	\$75.73	150	11S		View
Mason	Drywall Tapers	Journey Level	\$75.73	150	11S		View
Mason	Electrical Fixture Maintenance Workers	Journey Level	\$16.28		1		View
Mason	Electricians - Inside	Cable Splicer	\$90.59	5C	1G		View
Mason	Electricians - Inside	Journey Level	\$84.57	5C	1G		View
Mason	Electricians - Inside	Lead Covered Cable Splicer	\$96.63	5C	1G		View
Mason	Electricians - Inside	Welder	\$90.59	5C	1G		View
Mason	Electricians - Motor Shop	Craftsman	\$16.28		1		View
Mason	Electricians - Motor Shop	Journey Level	\$16.28		1		View
Mason	Electricians - Powerline Construction	Cable Splicer	\$93.00	5A	4D		View
Mason	Electricians - Powerline Construction	Certified Line Welder	\$85.42	5A	4D		View
Mason	Electricians - Powerline Construction	Groundperson	\$55.27	5A	4D		View
Mason	Electricians - Powerline Construction	Heavy Line Equipment Operator	\$85.42	5A	4D		View
Mason	Electricians - Powerline Construction	Journey Level Lineperson	\$85.42	5A	4D		View
Mason	Electricians - Powerline Construction	Line Equipment Operator	\$73.35	5A	4D		View
Mason	Electricians - Powerline Construction	Meter Installer	\$55.27	5A	4D	8W	View
Mason	Electricians - Powerline Construction	Pole Sprayer	\$85.42	5A	4D		View
Mason	Electricians - Powerline Construction	Powderperson	\$63.50	5A	4D		View
Mason	Electronic Technicians	Journey Level	\$53.46	6Z	1B		View
Mason	Elevator Constructors	Mechanic	\$111.26	7D	4A		View
Mason	Elevator Constructors	Mechanic In Charge	\$120.27	7D	4A		View
Mason	Fabricated Precast Concrete Products	Journey Level	\$16.28		1		View
Mason	Fabricated Precast Concrete Products	Journey Level - In-Factory Work Only	\$16.28		1		View

Mason	Fence Erectors	Fence Erector	\$50.07	15J	11P	8Y	View
Mason	Fence Erectors	Fence Laborer	\$50.07	15J	11P	8Y	View
Mason	Flaggers	Journey Level	\$50.07	15J	11P	8Y	View
Mason	Glaziers	Journey Level	\$79.16	7L	1Y		View
Mason	Heat & Frost Insulators And Asbestos Workers	Journey Level	\$87.15	15H	11C		View
Mason	Heating Equipment Mechanics	Journey Level	\$96.42	7F	1E		View
Mason	Hod Carriers & Mason Tenders	Journey Level	\$62.49	15J	11P	8Y	View
Mason	Industrial Power Vacuum Cleaner	Journey Level	\$16.28		1		View
Mason	Inland Boatmen	Boat Operator	\$61.41	5B	1K		View
Mason	Inland Boatmen	Cook	\$56.48	5B	1K		View
Mason	Inland Boatmen	Deckhand	\$57.48	5B	1K		View
Mason	Inland Boatmen	Deckhand Engineer	\$58.81	5B	1K		View
Mason	Inland Boatmen	Launch Operator	\$58.89	5B	1K		View
Mason	Inland Boatmen	Mate	\$57.31	5B	1K		View
Mason	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Cleaner Operator	\$49.48	15M	11O		View
Mason	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Foamer Operator	\$49.48	15M	11O		View
Mason	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Grout Truck Operator	\$49.48	15M	11O		View
Mason	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Head Operator	\$47.41	15M	11O		View
Mason	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Technician	\$41.20	15M	11O		View
Mason	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	TV Truck Operator	\$44.31	15M	11O		View
Mason	Insulation Applicators	Journey Level	\$74.96	15J	4C		View
Mason	Ironworkers	Journeyman	\$87.80	15K	11N		View
Mason	Laborers	Air, Gas Or Electric Vibrating Screed	\$59.07	15J	11P	8Y	View
Mason	Laborers	Airtrac Drill Operator	\$60.90	15J	11P	8Y	View
Mason	Laborers	Ballast Regular Machine	\$59.07	15J	11P	8Y	View
Mason	Laborers	Batch Weighman	\$50.07	15J	11P	8Y	View
Mason	Laborers	Brick Pavers	\$59.07	15J	11P	8Y	View
Mason	Laborers	Brush Cutter	\$59.07	15J	11P	8Y	View
Mason	Laborers	Brush Hog Feeder	\$59.07	15J	11P	8Y	View
Mason	Laborers	Burner	\$59.07	15J	11P	8Y	View
Mason	Laborers	Caisson Worker	\$60.90	15J	11P	8Y	View
Mason	Laborers	Carpenter Tender	\$59.07	15J	11P	8Y	View
Mason	Laborers	Cement Dumper-paving	\$60.15	15J	11P	8Y	View
Mason	Laborers	Cement Finisher Tender	\$59.07	15J	11P	8Y	View
Mason	Laborers	Change House Or Dry Shack	\$59.07	15J	11P	8Y	View

Mason	Laborers	Chipping Gun (30 Lbs. And Over)	\$60.15	15J	11P	8Y	View
Mason	Laborers	Chipping Gun (Under 30 Lbs.)	\$59.07	15J	11P	8Y	View
Mason	Laborers	Choker Setter	\$59.07	15J	11P	8Y	View
Mason	Laborers	Chuck Tender	\$59.07	15J	11P	8Y	View
Mason	Laborers	Clary Power Spreader	\$60.15	15J	11P	8Y	View
Mason	Laborers	Clean-up Laborer	\$59.07	15J	11P	8Y	View
Mason	Laborers	Concrete Dumper/Chute Operator	\$60.15	15J	11P	8Y	View
Mason	Laborers	Concrete Form Stripper	\$59.07	15J	11P	8Y	View
Mason	Laborers	Concrete Placement Crew	\$60.15	15J	11P	8Y	View
Mason	Laborers	Concrete Saw Operator/Core Driller	\$60.15	15J	11P	8Y	View
Mason	Laborers	Crusher Feeder	\$50.07	15J	11P	8Y	View
Mason	Laborers	Curing Laborer	\$59.07	15J	11P	8Y	View
Mason	Laborers	Demolition: Wrecking & Moving (Incl. Charred Material)	\$59.07	15J	11P	8Y	View
Mason	Laborers	Ditch Digger	\$59.07	15J	11P	8Y	View
Mason	Laborers	Diver	\$60.90	15J	11P	8Y	View
Mason	Laborers	Drill Operator (Hydraulic, Diamond)	\$60.15	15J	11P	8Y	View
Mason	Laborers	Dry Stack Walls	\$59.07	15J	11P	8Y	View
Mason	Laborers	Dump Person	\$59.07	15J	11P	8Y	View
Mason	Laborers	Epoxy Technician	\$59.07	15J	11P	8Y	View
Mason	Laborers	Erosion Control Worker	\$59.07	15J	11P	8Y	View
Mason	Laborers	Faller & Bucker Chain Saw	\$60.15	15J	11P	8Y	View
Mason	Laborers	Fine Graders	\$59.07	15J	11P	8Y	View
Mason	Laborers	Firewatch	\$50.07	15J	11P	8Y	View
Mason	Laborers	Form Setter	\$60.15	15J	11P	8Y	View
Mason	Laborers	Gabian Basket Builders	\$59.07	15J	11P	8Y	View
Mason	Laborers	General Laborer	\$59.07	15J	11P	8Y	View
Mason	Laborers	Grade Checker & Transit Person	\$62.49	15J	11P	8Y	View
Mason	Laborers	Grinders	\$59.07	15J	11P	8Y	View
Mason	Laborers	Grout Machine Tender	\$59.07	15J	11P	8Y	View
Mason	Laborers	Groutmen (Pressure) Including Post Tension Beams	\$60.15	15J	11P	8Y	View
Mason	Laborers	Guardrail Erector	\$59.07	15J	11P	8Y	View
Mason	Laborers	Hazardous Waste Worker (Level A)	\$60.90	15J	11P	8Y	View
Mason	Laborers	Hazardous Waste Worker (Level B)	\$60.15	15J	11P	8Y	View
Mason	Laborers	Hazardous Waste Worker (Level C)	\$59.07	15J	11P	8Y	View
Mason	Laborers	High Scaler	\$60.90	15J	11P	8Y	View
Mason	Laborers	Jackhammer	\$60.15	15J	11P	8Y	View
Mason	Laborers	Laserbeam Operator	\$60.15	15J	11P	8Y	View
Mason	Laborers	Maintenance Person	\$59.07	15J	11P	8Y	View
Mason	Laborers	Manhole Builder-Mudman	\$60.15	15J	11P	8Y	View

Mason	Laborers	Material Yard Person	\$59.07	15J	11P	8Y	View
Mason	Laborers	Mold Abatement Worker	\$59.07	15J	11P	8Y	View
Mason	Laborers	Motorman-Dinky Locomotive	\$62.59	15J	11P	8Y	View
Mason	Laborers	nozzleman (concrete pump, green cutter when using combination of high pressure air & water on concrete & rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster)	\$62.49	15J	11P	8Y	View
Mason	Laborers	Pavement Breaker	\$60.15	15J	11P	8Y	View
Mason	Laborers	Pilot Car	\$50.07	15J	11P	8Y	View
Mason	Laborers	Pipe Layer (Lead)	\$62.49	15J	11P	8Y	View
Mason	Laborers	Pipe Layer/Tailor	\$60.15	15J	11P	8Y	View
Mason	Laborers	Pipe Pot Tender	\$60.15	15J	11P	8Y	View
Mason	Laborers	Pipe Reliner	\$60.15	15J	11P	8Y	View
Mason	Laborers	Pipe Wrapper	\$60.15	15J	11P	8Y	View
Mason	Laborers	Pot Tender	\$59.07	15J	11P	8Y	View
Mason	Laborers	Powderman	\$60.90	15J	11P	8Y	View
Mason	Laborers	Powderman's Helper	\$59.07	15J	11P	8Y	View
Mason	Laborers	Power Jacks	\$60.15	15J	11P	8Y	View
Mason	Laborers	Railroad Spike Puller - Power	\$60.15	15J	11P	8Y	View
Mason	Laborers	Raker - Asphalt	\$62.49	15J	11P	8Y	View
Mason	Laborers	Re-timberman	\$60.90	15J	11P	8Y	View
Mason	Laborers	Remote Equipment Operator	\$60.15	15J	11P	8Y	View
Mason	Laborers	Rigger/Signal Person	\$60.15	15J	11P	8Y	View
Mason	Laborers	Rip Rap Person	\$59.07	15J	11P	8Y	View
Mason	Laborers	Rivet Buster	\$60.15	15J	11P	8Y	View
Mason	Laborers	Rodder	\$60.15	15J	11P	8Y	View
Mason	Laborers	Scaffold Erector	\$59.07	15J	11P	8Y	View
Mason	Laborers	Scale Person	\$59.07	15J	11P	8Y	View
Mason	Laborers	Sloper (Over 20")	\$60.15	15J	11P	8Y	View
Mason	Laborers	Sloper Sprayer	\$59.07	15J	11P	8Y	View
Mason	Laborers	Spreader (Concrete)	\$60.15	15J	11P	8Y	View
Mason	Laborers	Stake Hopper	\$59.07	15J	11P	8Y	View
Mason	Laborers	Stock Piler	\$59.07	15J	11P	8Y	View
Mason	Laborers	Swinging Stage/Boatswain Chair	\$50.07	15J	11P	8Y	View
Mason	Laborers	Tamper & Similar Electric, Air & Gas Operated Tools	\$60.15	15J	11P	8Y	View
Mason	Laborers	Tamper (Multiple & Self-propelled)	\$60.15	15J	11P	8Y	View
Mason	Laborers	Timber Person - Sewer (Lagger, Shorer & Cribber)	\$60.15	15J	11P	8Y	View
Mason	Laborers	Toolroom Person (at Jobsite)	\$59.07	15J	11P	8Y	View
Mason	Laborers	Topper	\$59.07	15J	11P	8Y	View
Mason	Laborers	Track Laborer	\$59.07	15J	11P	8Y	View
Mason	Laborers	Track Liner (Power)	\$60.15	15J	11P	8Y	View
Mason	Laborers	Traffic Control Laborer	\$53.54	15J	11P	9C	View
Mason	Laborers	Traffic Control Supervisor	\$56.73	15J	11P	9C	View

Mason	Laborers	Truck Spotter	\$59.07	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers	Tugger Operator	\$60.15	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers	Tunnel Work-Compressed Air Worker 0-30 psi	\$175.79	<u>15J</u>	<u>11P</u>	<u>9B</u>	View
Mason	Laborers	Tunnel Work-Compressed Air Worker 30.01-44.00 psi	\$180.82	<u>15J</u>	<u>11P</u>	<u>9B</u>	View
Mason	Laborers	Tunnel Work-Compressed Air Worker 44.01-54.00 psi	\$184.50	<u>15J</u>	<u>11P</u>	<u>9B</u>	View
Mason	Laborers	Tunnel Work-Compressed Air Worker 54.01-60.00 psi	\$190.20	<u>15J</u>	<u>11P</u>	<u>9B</u>	View
Mason	Laborers	Tunnel Work-Compressed Air Worker 60.01-64.00 psi	\$192.32	<u>15J</u>	<u>11P</u>	<u>9B</u>	View
Mason	Laborers	Tunnel Work-Compressed Air Worker 64.01-68.00 psi	\$197.42	<u>15J</u>	<u>11P</u>	<u>9B</u>	View
Mason	Laborers	Tunnel Work-Compressed Air Worker 68.01-70.00 psi	\$199.32	<u>15J</u>	<u>11P</u>	<u>9B</u>	View
Mason	Laborers	Tunnel Work-Compressed Air Worker 70.01-72.00 psi	\$201.32	<u>15J</u>	<u>11P</u>	<u>9B</u>	View
Mason	Laborers	Tunnel Work-Compressed Air Worker 72.01-74.00 psi	\$203.32	<u>15J</u>	<u>11P</u>	<u>9B</u>	View
Mason	Laborers	Tunnel Work-Guage and Lock Tender	\$62.59	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers	Tunnel Work-Miner	\$62.59	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers	Vibrator	\$60.15	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers	Vinyl Seamer	\$59.07	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers	Watchman	\$45.51	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers	Welder	\$60.15	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers	Well Point Laborer	\$60.15	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers	Window Washer/Cleaner	\$45.51	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers - Underground Sewer & Water	General Laborer & Topman	\$59.07	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Laborers - Underground Sewer & Water	Pipe Layer	\$60.15	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Landscape Construction	Landscape Construction/ Landscaping Or Planting Laborers	\$45.51	<u>15J</u>	<u>11P</u>	<u>8Y</u>	View
Mason	Landscape Construction	Landscape Operator	\$78.71	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Landscape Maintenance	Groundskeeper	\$16.28		<u>1</u>		View
Mason	Lathers	Journey Level	\$75.73	<u>15O</u>	<u>11S</u>		View
Mason	Marble Setters	Journey Level	\$69.07	<u>7E</u>	<u>1N</u>		View
Mason	Metal Fabrication (In Shop)	Fitter	\$16.28		<u>1</u>		View
Mason	Metal Fabrication (In Shop)	Laborer	\$16.28		<u>1</u>		View
Mason	Metal Fabrication (In Shop)	Machine Operator	\$16.28		<u>1</u>		View
Mason	Metal Fabrication (In Shop)	Painter	\$16.28		<u>1</u>		View
Mason	Metal Fabrication (In Shop)	Welder	\$16.28		<u>1</u>		View
Mason	Millwright	Journey Level	\$76.51	<u>15J</u>	<u>4C</u>		View
Mason	Modular Buildings	Cabinet Assembly	\$16.28		<u>1</u>		View
Mason	Modular Buildings	Electrician	\$16.28		<u>1</u>		View
Mason	Modular Buildings	Equipment Maintenance	\$16.28		<u>1</u>		View
Mason	Modular Buildings	Plumber	\$16.28		<u>1</u>		View
Mason	Modular Buildings	Production Worker	\$16.28		<u>1</u>		View

Mason	Modular Buildings	Tool Maintenance	\$16.28		<u>1</u>		View
Mason	Modular Buildings	Utility Person	\$16.28		<u>1</u>		View
Mason	Modular Buildings	Welder	\$16.28		<u>1</u>		View
Mason	Painters	Journey Level	\$51.71	<u>6Z</u>	<u>11J</u>		View
Mason	Pile Driver	Crew Tender	\$80.82	<u>15J</u>	<u>4C</u>		View
Mason	Pile Driver	Journey Level	\$75.41	<u>15J</u>	<u>4C</u>		View
Mason	Plasterers	Journey Level	\$70.91	<u>7Q</u>	<u>1R</u>		View
Mason	Plasterers	Nozzleman	\$74.91	<u>7Q</u>	<u>1R</u>		View
Mason	Playground & Park Equipment Installers	Journey Level	\$16.28		<u>1</u>		View
Mason	Plumbers & Pipefitters	Journey Level	\$86.72	<u>5A</u>	<u>1G</u>		View
Mason	Power Equipment Operators	Asphalt Plant Operators	\$80.02	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Assistant Engineer	\$75.26	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Barrier Machine (zipper)	\$79.31	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Batch Plant Operator: concrete	\$79.31	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Boat Operator	\$80.05	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Bobcat	\$75.26	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Brokk - Remote Demolition Equipment	\$75.26	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Brooms	\$75.26	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Bump Cutter	\$79.31	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Cableways	\$80.02	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Chipper	\$79.31	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Compressor	\$75.26	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Concrete Finish Machine - Laser Screed	\$75.26	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	\$78.71	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	\$80.02	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	\$79.31	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Conveyors	\$78.71	<u>15J</u>	<u>11G</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Cranes Friction: 200 tons and over	\$82.49	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Cranes, A-frame: 10 tons and under	\$75.29	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Cranes: 100 tons through 199 tons, or 150' of boom (including jib with attachments)	\$80.86	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Cranes: 20 tons through 44 tons with attachments	\$79.35	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Power Equipment Operators	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	\$81.69	<u>7A</u>	<u>11H</u>	<u>8X</u>	View

Mason	Power Equipment Operators	Cranes: 300 tons and over or 300' of boom including jib with attachments	\$82.49	7A	11H	8X	View
Mason	Power Equipment Operators	Cranes: 45 tons through 99 tons, under 150' of boom(including jib with attachments)	\$80.05	7A	11H	8X	View
Mason	Power Equipment Operators	Cranes: Friction cranes through 199 tons	\$81.69	7A	11H	8X	View
Mason	Power Equipment Operators	Cranes: through 19 tons with attachments, a-frame over 10 tons	\$78.74	7A	11H	8X	View
Mason	Power Equipment Operators	Crusher	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Deck Engineer/Deck Winches (power)	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Derricks, On Building Work	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Dozers D-9 & Under	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Drill Oilers: Auger Type, Truck Or Crane Mount	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Drilling Machine	\$80.82	15J	11G	8X	View
Mason	Power Equipment Operators	Elevator and man-lift: permanent and shaft type	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Finishing Machine, Bidwell And Gamaco & Similar Equipment	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Forklift: 3000 lbs and over with attachments	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Forklifts: under 3000 lbs. with attachments	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Gradechecker/Stakeman	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Guardrail Punch	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Horizontal/Directional Drill Locator	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Horizontal/Directional Drill Operator	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Hydralifts/Boom Trucks Over 10 Tons	\$78.74	7A	11H	8X	View
Mason	Power Equipment Operators	Hydralifts/boom trucks: 10 tons and under	\$75.29	7A	11H	8X	View
Mason	Power Equipment Operators	Leverman	\$81.65	15J	11G	8X	View
Mason	Power Equipment Operators	Loader, Overhead, 6 Yards. But Not Including 8 Yards	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Loaders, Overhead Under 6 Yards	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Loaders, Plant Feed	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Loaders: Elevating Type Belt	\$78.71	15J	11G	8X	View

Mason	Power Equipment Operators	Locomotives, All	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Material Transfer Device	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Mechanics: All (Leadmen - \$0.50 per hour over mechanic)	\$80.82	15J	11G	8X	View
Mason	Power Equipment Operators	Motor Patrol Graders	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Oil Distributors, Blower Distribution & Mulch Seeding Operator	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Outside Hoists (Elevators and Manlifts), Air Tuggers, Strato	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Overhead, bridge type Crane: 20 tons through 44 tons	\$79.35	7A	11H	8X	View
Mason	Power Equipment Operators	Overhead, bridge type: 100 tons and over	\$80.86	7A	11H	8X	View
Mason	Power Equipment Operators	Overhead, bridge type: 45 tons through 99 tons	\$80.05	7A	11H	8X	View
Mason	Power Equipment Operators	Pavement Breaker	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Pile Driver (other Than Crane Mount)	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Plant Oiler - Asphalt, Crusher	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Posthole Digger, Mechanical	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Power Plant	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Pumps - Water	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Quad 9, Hd 41, D10 And Over	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Quick Tower: no cab, under 100 feet in height base to boom	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Remote Control Operator On Rubber Tired Earth Moving Equipment	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Rigger and Bellman	\$75.29	7A	11H	8X	View
Mason	Power Equipment Operators	Rigger/Signal Person, Bellman(Certified)	\$78.74	7A	11H	8X	View
Mason	Power Equipment Operators	Rollagon	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Roller, Other Than Plant Mix	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Roller, Plant Mix Or Multi-lift Materials	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Roto-mill, Roto-grinder	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Saws - Concrete	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Scraper, Self Propelled Under 45 Yards	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Scrapers - Concrete & Carry All	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Scrapers, Self-propelled: 45 Yards And Over	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Service Engineers: Equipment	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Shotcrete/Gunite Equipment	\$75.26	15J	11G	8X	View

Mason	Power Equipment Operators	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	\$80.82	15J	11G	8X	View
Mason	Power Equipment Operators	Shovel, Excavator, Backhoes: Over 90 Metric Tons	\$81.65	15J	11G	8X	View
Mason	Power Equipment Operators	Slipform Pavers	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Spreader, Topsider & Screedman	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Subgrader Trimmer	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Tower Bucket Elevators	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Tower Crane: over 175' through 250' in height, base to boom	\$81.69	7A	11H	8X	View
Mason	Power Equipment Operators	Tower crane: up to 175' in height base to boom	\$80.86	7A	11H	8X	View
Mason	Power Equipment Operators	Tower Cranes: over 250' in height from base to boom	\$82.49	7A	11H	8X	View
Mason	Power Equipment Operators	Transporters, All Track Or Truck Type	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Trenching Machines	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators	Truck Crane Oiler/Driver: 100 tons and over	\$79.35	7A	11H	8X	View
Mason	Power Equipment Operators	Truck crane oiler/driver: under 100 tons	\$78.74	7A	11H	8X	View
Mason	Power Equipment Operators	Truck Mount Portable Conveyor	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Vac Truck (Vactor Guzzler, Hydro Excavator)	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators	Welder	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators	Wheel Tractors, Farmall Type	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators	Yo Yo Pay Dozer	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Asphalt Plant Operators	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Assistant Engineer	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Barrier Machine (zipper)	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Batch Plant Operator, Concrete	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Boat Operator	\$80.05	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Bobcat	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Brokk - Remote Demolition Equipment	\$75.26	15J	11G	8X	View

Mason	Power Equipment Operators-Underground Sewer & Water	Brooms	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Bump Cutter	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cableways	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Chipper	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Compressor	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Concrete Finish Machine - Laser Screed	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Conveyors	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cranes Friction: 200 tons and over	\$82.49	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cranes, A-frame: 10 tons and under	\$75.29	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cranes: 100 tons through 199 tons, or 150' of boom (including jib with attachments)	\$80.86	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cranes: 20 tons through 44 tons with attachments	\$79.35	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	\$81.69	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cranes: 300 tons and over or 300' of boom including jib with attachments	\$82.49	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cranes: 45 tons through 99 tons, under 150' of boom(including jib with attachments)	\$80.05	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cranes: Friction cranes through 199 tons	\$81.69	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Cranes: through 19 tons with attachments, a-frame over 10 tons	\$78.74	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Crusher	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Deck Engineer /Deck Winches (power)	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Derricks, On Building Work	\$80.02	15J	11G	8X	View

Mason	Power Equipment Operators-Underground Sewer & Water	Dozers D-9 & Under	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Drill Oilers: Auger Type, Truck Or Crane Mount	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Drilling Machine	\$80.82	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Elevator and man-lift: permanent and shaft type	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Finishing Machine, Bidwell And Gamaco & Similar Equipment	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Forklift: 3000 lbs and over with attachments	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Forklifts: under 3000 lbs. with attachments	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Gradechecker/Stakeman	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Guardrail Punch	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Horizontal/Directional Drill Locator	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Horizontal/Directional Drill Operator	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Hydralifts/boom trucks: 10 tons and under	\$75.29	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Hydralifts/boom trucks: over 10 tons	\$78.74	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Leverman	\$81.65	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Loader, Overhead, 6 Yards. But Not Including 8 Yards	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Loaders, Overhead Under 6 Yards	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Loaders, Plant Feed	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Loaders: Elevating Type Belt	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Locomotives, All	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Material Transfer Device	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Mechanics: All (Leadmen - \$0.50 per hour over mechanic)	\$80.82	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Motor Patrol Graders	\$80.02	15J	11G	8X	View

Mason	Power Equipment Operators-Underground Sewer & Water	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Oil Distributors, Blower Distribution & Mulch Seeding Operator	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Outside Hoists (Elevators and Manlifts), Air Tuggers, Strato	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Overhead, bridge type Crane: 20 tons through 44 tons	\$79.35	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Overhead, bridge type: 100 tons and over	\$80.86	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Overhead, bridge type: 45 tons through 99 tons	\$80.05	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Pavement Breaker	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Pile Driver (other Than Crane Mount)	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Plant Oiler - Asphalt, Crusher	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Posthole Digger, Mechanical	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Power Plant	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Pumps - Water	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Quad 9, Hd 41, D10 And Over	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Quick Tower: no cab, under 100 feet in height base to boom	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Remote Control Operator On Rubber Tired Earth Moving Equipment	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Rigger and Bellman	\$75.29	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Rigger/Signal Person, Bellman(Certified)	\$78.74	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Rollagon	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Roller, Other Than Plant Mix	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Roller, Plant Mix Or Multi-lift Materials	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Roto-mill, Roto-grinder	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Saws - Concrete	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Scraper, Self Propelled Under 45 Yards	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Scrapers - Concrete & Carry All	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Scrapers, Self-propelled: 45 Yards And Over	\$80.02	15J	11G	8X	View

Mason	Power Equipment Operators-Underground Sewer & Water	Shotcrete/Gunite Equipment	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	\$80.82	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 90 Metric Tons	\$81.65	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Slipform Pavers	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Spreader, Topsider & Screedman	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Subgrader Trimmer	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Tower Bucket Elevators	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Tower Crane: over 175' through 250' in height, base to boom	\$81.69	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Tower crane: up to 175' in height base to boom	\$80.86	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Tower Cranes: over 250' in height from base to boom	\$82.49	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Transporters, All Track Or Truck Type	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Trenching Machines	\$78.71	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Truck Crane Oiler/Driver: 100 tons and over	\$79.35	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Truck crane oiler/driver: under 100 tons	\$78.74	7A	11H	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Truck Mount Portable Conveyor	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Vac Truck (Vactor Guzzler, Hydro Excavator)	\$79.31	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Welder	\$80.02	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Wheel Tractors, Farmall Type	\$75.26	15J	11G	8X	View
Mason	Power Equipment Operators-Underground Sewer & Water	Yo Yo Pay Dozer	\$79.31	15J	11G	8X	View
Mason	Power Line Clearance Tree Trimmers	Journey Level In Charge	\$57.22	5A	4A		View
Mason	Power Line Clearance Tree Trimmers	Spray Person	\$54.32	5A	4A		View
Mason	Power Line Clearance Tree Trimmers	Tree Equipment Operator	\$57.22	5A	4A		View

Mason	Power Line Clearance Tree Trimmers	Tree Trimmer	\$51.18	5A	4A	View
Mason	Power Line Clearance Tree Trimmers	Tree Trimmer Groundperson	\$38.99	5A	4A	View
Mason	Refrigeration & Air Conditioning Mechanics	Journey Level	\$89.21	5A	1G	View
Mason	Residential Brick Mason	Journey Level	\$21.96		1	View
Mason	Residential Carpenters	Journey Level	\$49.93	15J	4C	View
Mason	Residential Cement Masons	Journey Level	\$18.97		1	View
Mason	Residential Drywall Applicators	Journey Level	\$49.92	15J	4C	View
Mason	Residential Drywall Tapers	Journey Level	\$24.48		1	View
Mason	Residential Electricians	Journey Level	\$44.11		1	View
Mason	Residential Glaziers	Journey Level	\$54.00	7L	1H	View
Mason	Residential Insulation Applicators	Journey Level	\$18.03		1	View
Mason	Residential Laborers	Journey Level	\$20.20		1	View
Mason	Residential Marble Setters	Journey Level	\$21.96		1	View
Mason	Residential Painters	Journey Level	\$18.14		1	View
Mason	Residential Plumbers & Pipefitters	Journey Level	\$30.02		1	View
Mason	Residential Refrigeration & Air Conditioning Mechanics	Journey Level	\$45.46		1	View
Mason	Residential Sheet Metal Workers	Journey Level (Field or Shop)	\$57.31	7F	1R	View
Mason	Residential Soft Floor Layers	Journey Level	\$22.69		1	View
Mason	Residential Sprinkler Fitters (Fire Protection)	Journey Level	\$22.92		1	View
Mason	Residential Stone Masons	Journey Level	\$47.73		1	View
Mason	Residential Terrazzo Workers	Journey Level	\$16.28		1	View
Mason	Residential Terrazzo/Tile Finishers	Journey Level	\$16.28		1	View
Mason	Residential Tile Setters	Journey Level	\$21.52		1	View
Mason	Roofers	Journey Level	\$64.45	5A	3H	View
Mason	Roofers	Using Irritable Bituminous Materials	\$67.39	5A	3H	View
Mason	Sheet Metal Workers	Journey Level (Field or Shop)	\$96.42	7F	1E	View
Mason	Shipbuilding & Ship Repair	New Construction Boilermaker	\$51.85	7X	4J	View
Mason	Shipbuilding & Ship Repair	New Construction Carpenter	\$51.85	7X	4J	View
Mason	Shipbuilding & Ship Repair	New Construction Crane Operator	\$43.16	7V	1	View
Mason	Shipbuilding & Ship Repair	New Construction Electrician	\$51.85	7X	4J	View
Mason	Shipbuilding & Ship Repair	New Construction Heat & Frost Insulator	\$87.15	15H	11C	View
Mason	Shipbuilding & Ship Repair	New Construction Laborer	\$51.85	7X	4J	View
Mason	Shipbuilding & Ship Repair	New Construction Machinist	\$51.85	7X	4J	View
Mason	Shipbuilding & Ship Repair	New Construction Operating Engineer	\$43.16	7V	1	View
Mason	Shipbuilding & Ship Repair	New Construction Painter	\$51.95	7X	4J	View
Mason	Shipbuilding & Ship Repair	New Construction Pipefitter	\$51.85	7X	4J	View
Mason	Shipbuilding & Ship Repair	New Construction Rigger	\$51.85	7X	4J	View

Mason	Shipbuilding & Ship Repair	New Construction Sheet Metal	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	New Construction Shipwright	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	New Construction Warehouse / Teamster	\$43.16	<u>7V</u>	<u>1</u>		View
Mason	Shipbuilding & Ship Repair	New Construction Welder / Burner	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Boilermaker	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Carpenter	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Crane Operator	\$45.06	<u>7Y</u>	<u>4K</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Electrician	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Heat & Frost Insulator	\$87.15	<u>15H</u>	<u>11C</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Laborer	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Machinist	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Operating Engineer	\$45.06	<u>7Y</u>	<u>4K</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Painter	\$51.95	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Pipefitter	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Rigger	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Sheet Metal	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Shipwright	\$51.85	<u>7X</u>	<u>4J</u>		View
Mason	Shipbuilding & Ship Repair	Ship Repair Warehouse / Teamster	\$45.06	<u>7Y</u>	<u>4K</u>		View
Mason	Sign Makers & Installers (Electrical)	Journey Level	\$18.04		<u>1</u>		View
Mason	Sign Makers & Installers (Non-Electrical)	Journey Level	\$18.04		<u>1</u>		View
Mason	Soft Floor Layers	Journey Level	\$66.32	<u>15J</u>	<u>4C</u>		View
Mason	Solar Controls For Windows	Journey Level	\$16.28		<u>1</u>		View
Mason	Sprinkler Fitters (Fire Protection)	Journey Level	\$73.15	<u>7J</u>	<u>1R</u>		View
Mason	Stage Rigging Mechanics (Non Structural)	Journey Level	\$16.28		<u>1</u>		View
Mason	Stone Masons	Journey Level	\$69.07	<u>7E</u>	<u>1N</u>		View
Mason	Street And Parking Lot Sweeper Workers	Journey Level	\$16.28		<u>1</u>		View
Mason	Surveyors	Assistant Construction Site Surveyor	\$78.74	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Surveyors	Chainman	\$75.29	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Surveyors	Construction Site Surveyor	\$80.05	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Surveyors	Drone Operator (when used in conjunction with survey work only)	\$75.29	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Surveyors	Ground Penetrating Radar Operator	\$75.29	<u>7A</u>	<u>11H</u>	<u>8X</u>	View
Mason	Telecommunication Technicians	Journey Level	\$53.46	<u>6Z</u>	<u>1B</u>		View
Mason	Telephone Line Construction - Outside	Cable Splicer	\$40.36	<u>5A</u>	<u>2B</u>		View
Mason	Telephone Line Construction - Outside	Hole Digger / Ground Person	\$26.92	<u>5A</u>	<u>2B</u>		View

Mason	Telephone Line Construction - Outside	Telephone Equipment Operator (Light)	\$33.74	<u>5A</u>	<u>2B</u>		View
Mason	Telephone Line Construction - Outside	Telephone Lineperson	\$38.15	<u>5A</u>	<u>2B</u>		View
Mason	Terrazzo Workers	Journey Level	\$62.36	<u>7E</u>	<u>1N</u>		View
Mason	Tile Setters	Journey Level	\$62.36	<u>7E</u>	<u>1N</u>		View
Mason	Tile, Marble & Terrazzo Finishers	Finisher	\$53.19	<u>7E</u>	<u>1N</u>		View
Mason	Traffic Control Stripers	Journey Level	\$89.54	<u>15L</u>	<u>1K</u>		View
Mason	Truck Drivers	Asphalt Mix Over 16 Yards	\$74.20	<u>15J</u>	<u>11M</u>	<u>8L</u>	View
Mason	Truck Drivers	Asphalt Mix To 16 Yards	\$73.36	<u>15J</u>	<u>11M</u>	<u>8L</u>	View
Mason	Truck Drivers	Dump Truck	\$73.36	<u>15J</u>	<u>11M</u>	<u>8L</u>	View
Mason	Truck Drivers	Dump Truck & Trailer	\$74.20	<u>15J</u>	<u>11M</u>	<u>8L</u>	View
Mason	Truck Drivers	Other Trucks	\$74.20	<u>15J</u>	<u>11M</u>	<u>8L</u>	View
Mason	Truck Drivers - Ready Mix	Transit Mix	\$74.20	<u>15J</u>	<u>11M</u>	<u>8L</u>	View
Mason	Well Drillers & Irrigation Pump Installers	Irrigation Pump Installer	\$16.28		<u>1</u>		View
Mason	Well Drillers & Irrigation Pump Installers	Oiler	\$16.28		<u>1</u>		View
Mason	Well Drillers & Irrigation Pump Installers	Well Driller	\$18.61		<u>1</u>		View

Overtime Codes

Overtime calculations are based on the hourly rate actually paid to the worker. On public works projects, the hourly rate must be not less than the prevailing rate of wage minus the hourly rate of the cost of fringe benefits actually provided for the worker.

1. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.
 - B. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
 - C. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
 - D. The first two (2) hours before or after a five-eight (8) hour workweek day or a four-ten (10) hour workweek day and the first eight (8) hours worked the next day after either workweek shall be paid at one and one-half times the hourly rate of wage. All additional hours worked and all worked on Sundays and holidays shall be paid at double the hourly rate of wage.
 - E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
 - F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.
 - G. The first ten (10) hours worked on Saturdays and the first ten (10) hours worked on a fifth calendar weekday in a four-ten hour schedule, shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
 - H. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions or equipment breakdown) shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
 - I. All hours worked on Sundays and holidays shall also be paid at double the hourly rate of wage.
 - J. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage.
 - K. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.
 - M. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

- 1. N. All hours worked on Saturdays (except makeup days) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
- O. The first ten (10) hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays, holidays and after twelve (12) hours, Monday through Friday and after ten (10) hours on Saturday shall be paid at double the hourly rate of wage.
- P. All hours worked on Saturdays (except makeup days if circumstances warrant) and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.
- Q. The first two (2) hours after eight (8) regular hours Monday through Friday and up to ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays (except Christmas day) shall be paid at double the hourly rate of wage. All hours worked on Christmas day shall be paid at two and one-half times the hourly rate of wage.
- R. All hours worked on Sundays and holidays shall be paid at two times the hourly rate of wage.
- U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays (except Labor Day) shall be paid at two times the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.
- V. All hours worked on Sundays and holidays (except Thanksgiving Day and Christmas day) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Thanksgiving Day and Christmas day shall be paid at double the hourly rate of wage.
- W. All hours worked on Saturdays and Sundays (except make-up days due to conditions beyond the control of the employer) shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.
- X. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over twelve (12) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage. When holiday falls on Saturday or Sunday, the day before Saturday, Friday, and the day after Sunday, Monday, shall be considered the holiday and all work performed shall be paid at double the hourly rate of wage.
- Y. All hours worked outside the hours of 5:00 am and 5:00 pm (or such other hours as may be agreed upon by any employer and the employee) and all hours worked in excess of eight (8) hours per day (10 hours per day for a 4 x 10 workweek) and on Saturdays and holidays (except labor day) shall be paid at one and one-half times the hourly rate of wage. (except for employees who are absent from work without prior approval on a scheduled workday during the workweek shall be paid at the straight-time rate until they have worked 8 hours in a day (10 in a 4 x 10 workweek) or 40 hours during that workweek.) All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and Labor Day shall be paid at double the hourly rate of wage.
- Z. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid the straight time rate of pay in addition to holiday pay.

Overtime Codes Continued

2. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.
- B. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.
 - F. The first eight (8) hours worked on holidays shall be paid at the straight hourly rate of wage in addition to the holiday pay. All hours worked in excess of eight (8) hours on holidays shall be paid at double the hourly rate of wage.
 - M. This code appears to be missing. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage.
 - R. All hours worked on Sundays and holidays and all hours worked over sixty (60) in one week shall be paid at double the hourly rate of wage.
 - U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked over 12 hours in a day or on Sundays and holidays shall be paid at double the hourly rate of wage.
3. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.
- F. All hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on paid holidays shall be paid at two and one-half times the hourly rate of wage including holiday pay.
 - H. All work performed on Sundays between March 16th and October 14th and all Holidays shall be compensated for at two (2) times the regular rate of pay. Work performed on Sundays between October 15th and March 15th shall be compensated at one and one half (1-1/2) times the regular rate of pay.
 - J. All hours worked between the hours of 10:00 pm and 5:00 am, Monday through Friday, and all hours worked on Saturdays shall be paid at a one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
 - K. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the eight (8) hours rest period.

Overtime Codes Continued

4. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

- A. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage
- C. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay. On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay. All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.
- D. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturday, Sundays and holidays shall be paid at double the hourly rate of pay. Rates include all members of the assigned crew.

EXCEPTION:

On all multipole structures and steel transmission lines, switching stations, regulating, capacitor stations, generating plants, industrial plants, associated installations and substations, except those substations whose primary function is to feed a distribution system, will be paid overtime under the following rates:

The first two (2) hours after eight (8) regular hours Monday through Friday of overtime on a regular workday, shall be paid at one and one-half times the hourly rate of wage. All hours in excess of ten (10) hours will be at two (2) times the hourly rate of wage. The first eight (8) hours worked on Saturday will be paid at one and one-half (1-1/2) times the hourly rate of wage. All hours worked in excess of eight (8) hours on Saturday, and all hours worked on Sundays and holidays will be at the double the hourly rate of wage.

All overtime eligible hours performed on the above described work that is energized, shall be paid at the double the hourly rate of wage.

- E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one and one half (1½) times the regular shift rate for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
- G. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
- I. The First eight (8) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) per day on Saturdays shall be paid at double the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

4. J. The first eight (8) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) hours on a Saturday shall be paid at double the hourly rate of wage. All hours worked over twelve (12) in a day, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.
- K. All hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage, so long as Saturday is the sixth consecutive day worked. All hours worked over twelve (12) in a day Monday through Saturday, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.
- L. The first twelve (12) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on a Saturday in excess of twelve (12) hours shall be paid at double the hourly rate of pay. All hours worked over twelve (12) in a day Monday through Friday, and all hours worked on Sundays shall be paid at double the hourly rate of wage. All hours worked on a holiday shall be paid at one and one-half times the hourly rate of wage, except that all hours worked on Labor Day shall be paid at double the hourly rate of pay.
- S. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, work performed in excess of (10) hours shall be paid at one and one half (1-1/2) times the hourly rate of pay. On Monday through Friday, work performed outside the normal work hours of 6:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations).
- All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.
- Multiple Shift Operations: When the first shift of a multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. Special Shifts: The Special Shift Premium is the basic hourly rate of pay plus \$2.00 an hour. When due to conditions beyond the control of the employer or when an owner (not acting as the contractor), a government agency or the contract specifications require more than four (4) hours of a special shift can only be performed outside the normal 6am to 6pm shift then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid the special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday).
- U. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. (Except on makeup days if work is lost due to inclement weather, then the first eight (8) hours on Saturday may be paid the regular rate.) All hours worked over twelve (12) hours Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

4. X. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage. Work performed outside the normal shift of 6 am to 6pm shall be paid at one and one-half the straight time rate, (except for special shifts or three shift operations). All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. Shifts may be established when considered necessary by the Employer.

The Employer may establish shifts consisting of eight (8) or ten (10) hours of work (subject to WAC 296-127-022), that shall constitute a normal forty (40) hour work week. The Employer can change from a 5-eight to a 4-ten hour schedule or back to the other. All hours of work on these shifts shall be paid for at the straight time hourly rate. Work performed in excess of eight hours (or ten hours per day (subject to WAC 296-127-022) shall be paid at one and one-half the straight time rate.

When due to conditions beyond the control of the Employer, or when contract specifications require that work can only be performed outside the regular day shift, then by mutual agreement a special shift may be worked at the straight time rate, eight (8) hours work for eight (8) hours pay. The starting time shall be arranged to fit such conditions of work.

When an employee returns to work without at a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Overtime Codes Continued

11. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

B After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

C The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, and all hours on Sunday shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage. All non-overtime and non-holiday hours worked between 4:00 pm and 5:00 am, Monday through Friday, shall be paid at a premium rate of 15% over the hourly rate of wage.

D. All hours worked on Saturdays and holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

E. The first two (2) hours after eight (8) regular hours Monday through Friday, the first ten (10) hours on Saturday, and the first ten (10) hours worked on Holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, and Sundays shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

Overtime Codes Continued

11. F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
- On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one-half times the hourly rate of wage for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
- G. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage.
- All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.
- After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of nine (9) hours or more. When an employee returns to work without at least nine (9) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the nine (9) hours rest period.
- H. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage.
- All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.
- After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of ten (10) hours or more. When an employee returns to work without at least ten (10) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the ten (10) hours rest period.
- J. All hours worked on holidays shall be paid at double the hourly rate of wage.
- K. On Monday through Friday hours worked outside 4:00 am and 5:00 pm, and the first two (2) hours after eight (8) hours worked shall be paid at one and one-half times the hourly rate. All hours worked over 10 hours per day Monday through Friday, and all hours worked on Saturdays, Sundays, and Holidays worked shall be paid at double the hourly rate of wage.
- L. An employee working outside 5:00 am and 5:00 pm shall receive an additional two dollar (\$2.00) per hour for all hours worked that shift. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

Overtime Codes Continued

11. M. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.
- Work performed outside the normal work hours of 5:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations). When the first shift of a multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. When due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift of 5:00 am to 6:00 pm, then a special shift may be worked at the straight time rate, plus the shift pay premium when applicable. The starting time of work will be arranged to fit such conditions of work. Such shift shall consist of eight (8) hours work for eight (8) hours pay or ten (10) hours work for ten (10) hours pay for four ten shifts.
- On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay. All work performed after 6:00 pm Saturday to 5:00 am Monday, all work performed over twelve (12) hours, and all work performed on holidays shall be paid at double the straight time rate of pay.
- Shift Pay Premium: In an addition to any overtime already required, all hours worked between the hours of 6:00 pm and 5:00 am shall receive an additional two dollars (\$2.00) per hour.
- N. All work performed over twelve hours in a shift and all work performed on Sundays and Holidays shall be paid at double the straight time rate.
- Any time worked over eight (8) hours on Saturday shall be paid double the straight time rate, except employees assigned to work six 10-hour shifts per week shall be paid double the straight time rate for any time worked on Saturday over 10 hours.
- O. All work performed on Saturdays, Sundays, and Holidays shall be paid at one and one half (1-1/2) times the straight time rate of pay.

Overtime Codes Continued

11. P. Work performed in excess of ten (10) hours of straight time per day when four ten (10) hour shifts are established and all work on Saturdays, except for make-up days shall be paid at time and one-half (1 ½) the straight time rate.
- Work performed outside the normal work hours of 5:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations). When the first shift of multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. When due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift of 5:00 a.m. to 6:00 p.m., then a special shift may be worked at the straight time rate, plus the shift pay premium when applicable. The starting time of work will be arranged to fit such conditions of work. Such shifts shall consist of eight (8) hours work for eight (8) hours pay or ten (10) hours work for ten (10) hours pay for four ten-hour shifts.
- In the event the job is down due to weather conditions, then Saturday may, be worked as a voluntary make-up day at the straight time rate. However, Saturday shall not be utilized as a make-up day when a holiday falls on Friday. All work performed on Sundays and holidays and work in excess of twelve (12) hours per day shall be paid at double (2x) the straight time rate of pay.
- After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.
- When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.
- Q. All hours worked between the hours of 6:00 pm and 6:00 am, Monday through Saturday, shall be paid at a premium rate of 35% over the hourly rate of wage. Work performed on Sundays shall be paid at double time. All hours worked on holidays shall be paid at double the hourly rate of wage.
- R. On Monday through Saturday hours worked outside 6:00 am and 7:00 pm, and all hours after eight (8) hours worked shall be paid at one and one-half times the hourly rate. All hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.
- When a holiday falls on a Saturday, the Friday before shall be the observed holiday. When a holiday falls on a Sunday, the following Monday shall be the observed holiday.
- S. The first ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. In the event the job is down due to weather conditions, or other conditions beyond the control of the Employer, then Saturday may be worked at the straight time rate, for the first eight (8) hours, or the first ten (10) hours when a four day ten hour workweek has been established.
- All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
- When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Holiday Codes

- 5. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, and Christmas Day (7).
- B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, the day before Christmas, and Christmas Day (8).
- C. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).
- D. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8).
- H. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Day after Thanksgiving Day, And Christmas (6).
- I. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).
- K. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9).
- L. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (8).
- N. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, The Friday After Thanksgiving Day, And Christmas Day (9).
- P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday And Saturday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9). If A Holiday Falls On Sunday, The Following Monday Shall Be Considered As A Holiday.
- Q. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).
- R. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day After Thanksgiving Day, One-Half Day Before Christmas Day, And Christmas Day. (7 1/2).
- S. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, And Christmas Day (7).
- Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

Holiday Codes Continued

- 6. G. Paid Holidays: New Year's Day, Martin Luther King Jr. Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Christmas Eve Day (11).
- H. Paid Holidays: New Year's Day, New Year's Eve Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, Christmas Day, The Day After Christmas, And A Floating Holiday (10).
- T. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Last Working Day Before Christmas Day, And Christmas Day (9).
- Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). If a holiday falls on Saturday, the preceding Friday shall be considered as the holiday. If a holiday falls on Sunday, the following Monday shall be considered as the holiday.

Holiday Codes Continued

- 7. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any Holiday Which Falls On A Sunday Shall Be Observed As A Holiday On The Following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.
- B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- C. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- D. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Unpaid Holidays: President's Day. Any paid holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any paid holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- E. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- F. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the last working day before Christmas day and Christmas day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Holiday Codes Continued

7. G. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.
- H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- J. Holidays: New Year's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- L. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Last Work Day before Christmas Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. When Christmas falls on a Saturday, the preceding Friday shall be observed as a holiday.
- P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.
- Q. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.
- S. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, the Day after Christmas, and A Floating Holiday (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.
- V. Holidays: New Year's Day, President's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, the day before or after Christmas, and the day before or after New Year's Day. If any of the above listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.
- W. Holidays: New Year's Day, Day After New Year's, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day, Christmas Day, the day after Christmas, the day before New Year's Day, and a Floating Holiday.

Holiday Codes Continued

7. X. Holidays: New Year's Day, Day before or after New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day before or after Christmas day. If a holiday falls on a Saturday or on a Friday that is the normal day off, then the holiday will be taken on the last normal workday. If the holiday falls on a Monday that is the normal day off or on a Sunday, then the holiday will be taken on the next normal workday.
- Y. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day. (8) If the holiday falls on a Sunday, then the day observed by the federal government shall be considered a holiday and compensated accordingly.
- Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, Christmas Eve, and Christmas Day (9). Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday. Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Holiday Codes Continued

15. G. New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, the last scheduled workday before Christmas, and Christmas Day (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.
- H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- J. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.
- K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- L. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.
- M. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

Holiday Codes Continued

15. N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.
- O. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, the day before Christmas day, and Christmas Day (10). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Note Codes

8. D. Workers working with supplied air on hazmat projects receive an additional \$1.00 per hour.
- L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: \$0.75, Level B: \$0.50, And Level C: \$0.25.
- M. Workers on hazmat projects receive additional hourly premiums as follows: Levels A & B: \$1.00, Levels C & D: \$0.50.
- N. Workers on hazmat projects receive additional hourly premiums as follows -Level A: \$1.00, Level B: \$0.75, Level C: \$0.50, And Level D: \$0.25.
- S. Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.
- T. Effective August 31, 2012 – A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.
- U. Workers on hazmat projects receive additional hourly premiums as follows – Class A Suit: \$2.00, Class B Suit: \$1.50, And Class C Suit: \$1.00. Workers performing underground work receive an additional \$0.40 per hour for any and all work performed underground, including operating, servicing and repairing of equipment. The premium for underground work shall be paid for the entire shift worked. Workers who work suspended by a rope or cable receive an additional \$0.50 per hour. The premium for work suspended shall be paid for the entire shift worked. Workers who do “pioneer” work (break open a cut, build road, etc.) more than one hundred fifty (150) feet above grade elevation receive an additional \$0.50 per hour.

Note Codes Continued

8. V. In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.
- Depth premiums apply to depths of fifty feet or more. Over 50' to 100' - \$2.00 per foot for each foot over 50 feet. Over 101' to 150' - \$3.00 per foot for each foot over 101 feet. Over 151' to 220' - \$4.00 per foot for each foot over 220 feet. Over 221' - \$5.00 per foot for each foot over 221 feet.
- Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25' to 300' - \$1.00 per foot from entrance. 300' to 600' - \$1.50 per foot beginning at 300'. Over 600' - \$2.00 per foot beginning at 600'.
- W. Meter Installers work on single phase 120/240V self-contained residential meters. The Lineman/Groundmen rates would apply to meters not fitting this description.
- X. Workers on hazmat projects receive additional hourly premiums as follows - Class A Suit: \$2.00, Class B Suit: \$1.50, Class C Suit: \$1.00, and Class D Suit: \$0.50. Special Shift Premium: Basic hourly rate plus \$2.00 per hour.
- When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications requires that work can only be performed outside the normal 5 am to 6pm shift, then the special shift premium will be applied to the basic hourly rate. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in OT or Double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)
- Y. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay.
- Swinging Stage/Boatswains Chair: Employees working on a swinging state or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents (\$0.75) per hour above the classification rate.
- Z. Workers working with supplied air on hazmat projects receive an additional \$1.00 per hour.
- Special Shift Premium: Basic hourly rate plus \$2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as a contractor), a government agency or the contract specifications require that more than (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they will be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Note Codes Continued

9. A. Workers working with supplied air on hazmat projects receive an additional \$1.00 per hour.

Special Shift Premium: Basic hourly rate plus \$2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications require that more than four (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Certified Crane Operator Premium: Crane operators requiring certifications shall be paid \$0.50 per hour above their classification rate.

Boom Pay Premium: All cranes including tower shall be paid as follows based on boom length:

- (A) – 130’ to 199’ – \$0.50 per hour over their classification rate.
- (B) – 200’ to 299’ – \$0.80 per hour over their classification rate.
- (C) – 300’ and over – \$1.00 per hour over their classification rate.

- B. The highest pressure registered on the gauge for an accumulated time of more than fifteen (15) minutes during the shift shall be used in determining the scale paid.

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents (\$0.75) per hour above the classification rate.

- C. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents (\$0.75) per hour above the classification rate.

Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. These classifications are only effective on or after August 31, 2012.

- D. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, bridges, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.

- E. Heavy Construction includes construction, repair, alteration or additions to the production, fabrication or manufacturing portions of industrial or manufacturing plants, hydroelectric or nuclear power plants and atomic reactor construction. Workers on hazmat projects receive additional hourly premiums as follows -Level A: \$1.00, Level B: \$0.75, Level C: \$0.50, And Level D: \$0.25.

Note Codes Continued

- 9. F. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.
- H. One (1) person crew shall consist of a Party Chief. (Total Station or similar one (1) person survey system). Two (2) person survey party shall consist of a least a Party Chief and a Chain Person. Three (3) person survey party shall consist of at least a Party Chief, an Instrument Person, and a Chain Person.

PART 7

APPENDIX

APPENDIX A

SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA

APPENDIX A

**SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA FORMS
SHADOWOOD WATER SYSTEM IMPROVEMENTS**

These forms shall be completed in their entirety and submitted by the apparent two lowest Bidders to the Mason County PUD No. 1 by 12:00 p.m. (noon) of the second business day following the bid submittal deadline.

Failure to submit and meet the requirements as stated in Section 2.01.8 of the General Conditions shall be grounds for rejection of the bid. The Mason County PUD No. 1 will be the sole judge in determining if the prospective contractor meets the minimum experience requirements.

Contractor:

Name: _____

Address: _____

Phone: _____

Contact Person: _____

2. Delinquent State Taxes

Instructions to Bidders: Check the appropriate box

- The Bidder does not owe delinquent taxes to the Washington State Department of Revenue.
- Alternatively, the Bidder does owe delinquent taxes to the Washington State Department of Revenue.

If the Bidder owes delinquent taxes, they must submit a written payment plan approved by the Department of Revenue, to the Contracting Agency.

(Date)

(Signature)

(Print Name)

(Title)

3. Subcontractor Responsibility:

Instructions to Bidders: Check all boxes that apply

- The Bidder's standard subcontract form includes the subcontractor responsibility language required by RCW 39.06.020.
- The Bidder has a procedure for validating the responsibility of subcontractors with which the Bidder contracts.
- The Bidder's subcontract form includes a requirement that each of its subcontractors shall have and document a similar procedure to determine whether the sub-tier subcontractors with whom it contracts are also "responsible" subcontractors as defined by RCW 39.06.020.

If the Bidder is unable to check all of the above boxes, provide an explanation as to how the bidder will comply with RCW 39.06.020.

(Date)

(Signature)

(Print Name)

(Title)

4. Claims Against Retainage and Bonds:

Instructions to Bidders: Check the appropriate box

- The Bidder has not had claims against retainage and bonds in the 3 years prior to the bid submittal date.
- Alternatively, the Bidder has had claims against retainage and bonds in the 3 years prior to the bid submittal date.

If the Bidder has had claims against retainage and bonds in the 3 years prior to the bid submittal date, submit a list of public works projects completed during this period that have had claims against retainage and bonds and include name of Project, contact information for the Owner, a list of claims filed against retainage and/or payment bond for any of the projects listed; and a written explanation of circumstances surrounding each claim and the ultimate resolution of the claim.

(Date)

(Signature)

(Print Name)

(Title)

5. Public Bidding Crime:

Instructions to Bidders: Check the appropriate box

- The undersigned certifies that the Bidder and/or its Owners have not been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.

- Alternatively, the undersigned confirms that the Bidder and/or its Owners have been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.

If the Bidder and/or its Owners have been convicted of a crime involving bidding on a public works contract, provide a written explanation identifying the date of the conviction and a description of the circumstances surrounding the conviction.

(Date)

(Signature)

(Print Name)

(Title)

6. Termination for Cause/Termination for Default

Instructions to Bidders: Check the appropriate box

- The undersigned certifies that the Bidder has not had any public works contracts terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date.

- Alternatively, the undersigned confirms that the Bidder has had public works contracts terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date.

If the Bidder has had any public works contracts terminated for cause or terminated for default in the 5 years prior to the bid submittal date, provide a written explanation for all contracts terminated for cause or terminated for default by identifying the project contract that was terminated, the government agency which terminated the Contract, the date of the termination, and a description of the circumstances surrounding the termination.

(Date)

(Signature)

(Print Name)

(Title)

7. Lawsuits

Instructions to Bidders: Check the appropriate box

- The undersigned certifies that the Bidder has not had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts.

- Alternatively, the undersigned confirms that the Bidder has had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts.

If the Bidder has had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, submit a list of lawsuits along with a written explanation of the circumstances surrounding each lawsuit. The Contracting Agency shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet the terms of contracts.

(Date)

(Signature)

(Print Name)

(Title)

8. Contract Time (Liquidated Damages)

Instructions to Bidders: Check the appropriate box

- The undersigned certifies that the Bidder has not had liquidated damages assessed on any project it has completed in the 5 years prior to the bid submittal date.
- Alternatively, the undersigned confirms that the Bidder has had liquidated damages assessed on projects in the 5 years prior to the bid submittal date.

If the Bidder has had liquidated damages assessed against projects in the 5 years prior to the bid submittal date, submit a list of projects along with Owner contact information, and number of days assessed liquidated damages. The Contracting Agency shall determine whether the Contractor has a pattern of failing to complete projects within Contract Time.

(Date)

(Signature)

(Print Name)

(Title)

9. Capacity and Experience

The Bidder shall have sufficient current capacity and the Project Superintendent assigned to the Project shall have experience to meet the requirements of this Project. The Bidder and Project Superintendent shall have successfully completed at least two projects as the prime contractor, of a similar size and scope, during the 5-year period immediately preceding the bid submittal deadline for this project. Similar size is defined as a minimum of 70 percent of the bid amount submitted by the Bidder.

A. Capacity

i. Gross dollar amount of work currently under contract:

ii. Gross dollar amount of contracts currently not completed:

iii. List five major pieces of equipment which are anticipated to be used on this project by the Contractor and note which items are owned by the Contractor and which are to be leased or rented from others:

iv. Number of superintendents on Bidder's staff:

B. Experience

i. General character of work performed by firm:

ii. Identify who will be the superintendent on this project and years of experience. Also, list the number of years this person has been with your firm.

iii. Similar Size and Scope Projects Completed in the Past 5 Years

#1 Owner's Name and Contact Information: _____

Owner is a Government Agency? ___ Yes ___ No

Superintendent's Name: _____

Project Name: _____

Awarded Contract Amount: _____

Final Contract Amount: _____

Completion Date: _____

Project Description: _____

#2 Owner's Name and Contact Information: _____

Owner is a Government Agency? ___ Yes ___ No

Superintendent's Name: _____

Project Name: _____

Awarded Contract Amount: _____

Final Contract Amount: _____

Completion Date: _____

Project Description: _____

#3 Owner's Name and Contact Information: _____

Owner is a Government Agency? ___ Yes ___ No

Superintendent's Name: _____

Project Name: _____

Awarded Contract Amount: _____

Final Contract Amount: _____

Completion Date: _____

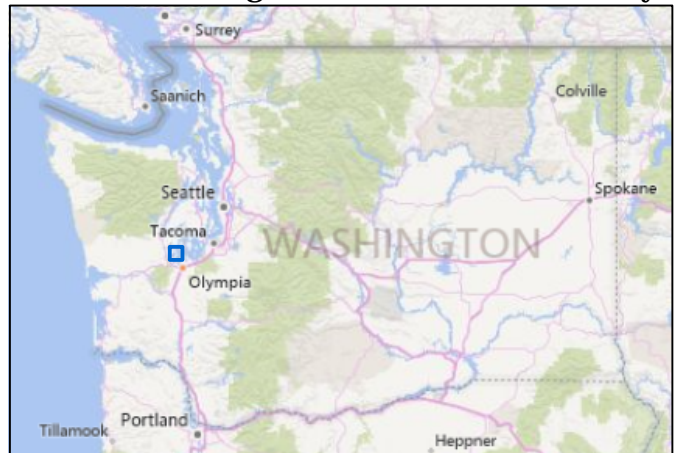
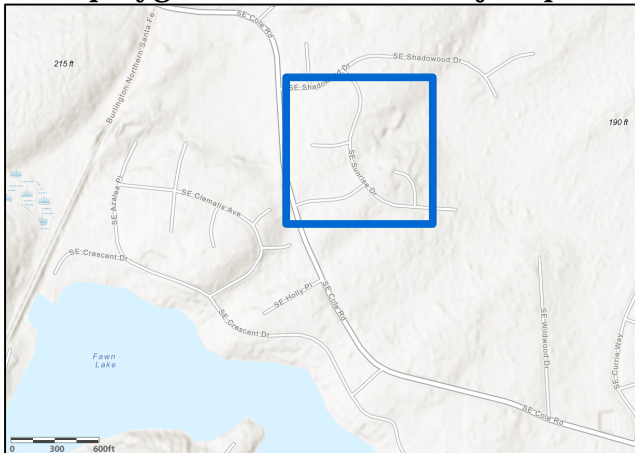
Project Description: _____

APPENDIX B

BORING LOGS
(FOR INFORMATION ONLY)



Red polygon outline is the subject parcel, and blue rectangles outline the site vicinity



file.grf w/ file.dat 7/3/22 (8:05:15) SDD



**Shadowood Water System
Improvements
131 SE Sunrise Drive
Shelton, Washington**

VICINITY MAP

Project No. **22-232**




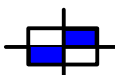

Figure No. **1**

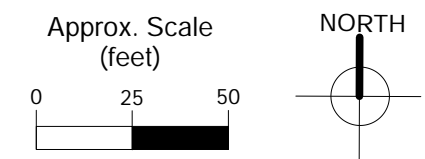
13-011_Fig 2 Site & Exploration Plan.grf 7/6/22-JCR


Note: Site plan modified from Proposed Site Plan, Gray & Osborne, Sheet C-3, Dated June 2022



LEGEND:

-  Subject Site
-  Existing Structures
-  Proposed Reservoir, Filter, and Booster Pump Building
-  Approximate Test Pit (TP) Location, PanGEO, Inc., June 2022 (Approximate Depth to Competent Soils)
-  Approximate Infiltration Test (IT) Location, PanGEO, Inc., June 2022



	Shadowood Water System Improvements 131 SE Sunrise Drive Shelton, Washington	SITE AND EXPLORATION PLAN	
		Project No. 22-232	Figure No. 2

SUMMARY TEST PIT LOGS

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)		GW: Well-graded GRAVEL
	GRAVEL (>12% fines)		GP: Poorly-graded GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)		GM: Silty GRAVEL
	SAND (>12% fines)		GC: Clayey GRAVEL
			SW: Well-graded SAND
			SP: Poorly-graded SAND
Silt and Clay 50% or more passing #200 sieve	Liquid Limit < 50		SM: Silty SAND
			SC: Clayey SAND
			ML: SILT
	Liquid Limit > 50		CL: Lean CLAY
			OL: Organic SILT or CLAY
			MH: Elastic SILT
			CH: Fat CLAY
Highly Organic Soils		OH: Organic SILT or CLAY	
		PT: PEAT	

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

- ATT Atterberg Limit Test
- Comp Compaction Tests
- Con Consolidation
- DD Dry Density
- DS Direct Shear
- %F Fines Content
- GS Grain Size
- Perm Permeability
- PP Pocket Penetrometer
- R R-value
- SG Specific Gravity
- TV Torvane
- TXC Triaxial Compression
- UCC Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Split Spoon (300-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

- Notes:**
- Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.
 - The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered: Units of material distinguished by color and/or composition from material units above and below	Fissured: Breaks along defined planes
Laminated: Layers of soil typically 0.05 to 1mm thick, max. 1 cm	Slickensided: Fracture planes that are polished or glossy
Lens: Layer of soil that pinches out laterally	Blocky: Angular soil lumps that resist breakdown
Interlayered: Alternating layers of differing soil material	Disrupted: Soil that is broken and mixed
Pocket: Erratic, discontinuous deposit of limited extent	Scattered: Less than one per foot
Homogeneous: Soil with uniform color and composition throughout	Numerous: More than one per foot
	BCN: Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel	3 to 3/4 inches	Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
		Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Coarse Gravel:	3 to 3/4 inches	Silt	0.074 to 0.002 mm
Fine Gravel:	3/4 inches to #4 sieve	Clay	<0.002 mm

MONITORING WELL

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level
- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring


MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

LOG KEY 16-056 LOGS.GPJ PANGEO.GDT 02/22/16


Test Pit Logs

Project No: 22-232
 Project Name: Shadowood Water System Improvements
 Project Location: 131 SE Sunrise Drive, Shelton, WA 98584
 Excavated: 6/21/2022

Test Pit No. TP-1	
Location: 47.16983429070707, -123.06762174395692 (WGS84)	
Approximate ground surface elevation: 182 feet (NAVD88)	
<u>Depth (ft)</u>	<u>Material Description</u>
0 – 0.5	Grass and topsoil over loose, brown, silty SAND with gravel (SM); moist, fine to medium sand, fine to coarse subangular to rounded gravel, numerous rootlets [Topsoil]
0.5 – 4.5	Medium dense to dense, gray-brown to tan, silty SAND with gravel and occasional cobble; moist, fine to medium sand, fine to coarse subangular to rounded gravel, dimictic soil structure [Weathered Glacial Till]
4.5 – 7	Dense to very dense, gray to tan, silty SAND with gravel and occasional cobble; moist, fine to medium sand, fine to coarse subangular to rounded gravel, moderate to heavy cementation between 4.5 feet and 6 feet, diamictic soil structure [Glacial Till]
7 – 12	Dense, gray, SAND with gravel; moist, fine to coarse sand, fine to coarse subrounded to well-rounded gravel, well-graded massive soil structure [Glacial Outwash]
	
Image of soils encountered approximately 11-feet below the existing ground surface (bgs). Groundwater was not encountered at the time of exploration. No soil caving or other indications of excavation instability were observed. Soil samples were collected at 3-, 6-, 7.5, and 10-feet bgs.	
Logged by: E. Eckles	


Test Pit Logs

Project No: 22-232
 Project Name: Shadowood Water System Improvements
 Project Location: 131 SE Sunrise Drive, Shelton, WA 98584
 Excavated: 6/21/2022

Test Pit No. TP-2	
Location: 47.170134177870096, -123.06769761722101 (WGS84)	
Approximate ground surface elevation: 190 feet (NAVD88)	
<u>Depth (ft)</u>	<u>Material Description</u>
0 – 0.4	Concrete pavement and steel rebar
0.4 – 5	Medium dense to dense, gray to brown SAND with gravel and scattered cobble; moist, fine to coarse sand, fine to coarse subangular to rounded gravel, well-graded massive soil structure [Fill]
5 – 7	Medium dense, tan to brown, SAND with gravel, trace silt, scattered cobble, and scattered organics; very fine to medium sand, fine to coarse subrounded to well-rounded gravel, wood debris and organic rootlets [Fill and Old Topsoil]
7 – 15	Dense gray SAND with gravel; moist, fine to coarse sand, fine to coarse subrounded to well-rounded gravel, well-graded soil structure [Outwash]
	
<p>Image of soils encountered approximately 6-feet below the existing ground surface (bgs). Groundwater was not encountered at the time of exploration. No soil caving or other indications of excavation instability were observed. Soil samples were collected at 4-, 6-, 10- and 15-feet bgs.</p> <p>Logged by: E. Eckles</p>	


Test Pit Logs

Project No: 22-232
 Project Name: Shadowood Water System Improvements
 Project Location: 131 SE Sunrise Drive, Shelton, WA 98584
 Excavated: 6/21/2022

Test Pit No. TP-3	
Location: 47.16999862908416, -123.06756528012899 (WGS84)	
Approximate ground surface elevation: 190 feet (NAVD88)	
<u>Depth (ft)</u>	<u>Material Description</u>
0 – 0.4	Concrete pavement and steel rebar
0.4 – 7	Medium dense to dense, gray to brown SAND with gravel and scattered cobble; moist, fine to coarse sand, fine to coarse subangular to rounded gravel, well-graded massive soil structure [Fill]
7 - 8	Dense, gray to tan, silty SAND with gravel and occasional cobble; very fine to medium sand, fine to coarse subangular to rounded gravel, wood debris and organic rootlets, orange-brown mottling, unsorted soil structure [Old Topsoil]
8 – 11	Dense to very dense, gray to tan, silty SAND with gravel and occasional cobble; very fine to medium sand, fine to coarse subangular to rounded gravel, orange-brown soil mottling between 7- and 8-feet, light to medium cementation between 8.5- and 10-feet, diamict soil structure [Weathered Glacial Till]
11 – 15	Dense, tan to gray, SAND with gravel; moist, fine to coarse sand, fine to coarse subrounded to well-rounded gravel, well-graded soil structure [Glacial Outwash]
	
<p>Image of soils encountered approximately 9-feet below the existing ground surface (bgs). Groundwater was not encountered at the time of exploration. Minor, <0.25-feet, sidewall caving was noted around wood debris at between 7- and 7.5-feet; no other indications of excavation instability were observed. Soil samples were collected at 3, 8, 12 and 15-feet below ground surface.</p> <p>Logged by: E. Eckles</p>	


Test Pit Logs

Project No: 22-232
 Project Name: Shadowood Water System Improvements
 Project Location: 131 SE Sunrise Drive, Shelton, WA 98584
 Excavated: 6/21/2022

Test Pit No. TP-4	
Location: 47.17006940238722, -123.0677876064436 (WGS84)	
Approximate ground surface elevation: 190 feet (NAVD88)	
<u>Depth (ft)</u>	<u>Material Description</u>
0 – 0.4	Concrete pavement and steel rebar
0.4 – 3	Medium dense to dense, gray to brown SAND with gravel and scattered cobble; moist, fine to coarse sand, fine to coarse subangular to rounded gravel, well-graded massive soil structure [Fill]
3 – 4	Medium dense, tan to brown, silty SAND with gravel, woody organics, and rootlets; moist, very fine to medium sand, fine to coarse subrounded to rounded gravel [Old Topsoil]
4 – 7	Dense to very dense, gray to tan, silty SAND with gravel and occasional cobble; very fine to medium sand, fine to coarse subangular to rounded gravel, light to medium cementation between 4.5- and 6-feet, diamict soil structure [Weathered Glacial Till]
8 – 15	Dense, gray, SAND with gravel and scattered cobble; moist, fine to coarse sand, fine to coarse subrounded to well-rounded gravel, well-graded matrix, scattered and pinched-out silt and sandy silt lenses between 12- and 15-feet [Glacial Outwash]
	
<p>Image of soils encountered approximately 6-feet below the existing ground surface (bgs). Groundwater was not encountered at the time of exploration. No soil caving or other indications of excavation instability were observed. Soil samples were collected at 2-, 4.5-, 7.5-, 12- and 15-feet bgs.</p> <p>Logged by: E. Eckles</p>	


Test Pit Logs

Project No: 22-232
 Project Name: Shadowood Water System Improvements
 Project Location: 131 SE Sunrise Drive, Shelton, WA 98584
 Excavated: 6/21/2022

Infiltration Pit No. IT-1	
Location: 47.16982606376965, -123.06700328548364 (WGS84)	
Approximate ground surface elevation: 179 feet (NAVD88)	
<u>Depth (ft)</u>	<u>Material Description</u>
0 – 1	Organics, topsoil, and forest duff [Topsoil]
1 – 5	Loose to medium dense, tan to brown, silty SAND to sandy SILT with some to trace gravel; moist, very fine to fine sand, fine to medium rounded gravel, massive soil structure [Weathered Colluvium]
5 – 15	Medium dense to dense, tan to gray-brown SILT to sandy SILT; very fine to fine sand, scattered minor fine sand lenses, orange to light-brown soil mottling between 12- and 15-feet, massive soil structure [Colluvium]
15 – 17	Dense, gray to tan, SAND with gravel and trace to some silt; fine to medium sand, fine to coarse subrounded to well-rounded gravel, well-graded and massive soil structure [Glacial Outwash]
	
<p>Image of silty soils encountered to approximately 15-feet below the existing ground surface (bgs). Groundwater was not encountered at the time of exploration. No soil caving or other indications of excavation instability were observed. Soil samples were collected at 3.5-, 6-, 12-, and 15-feet.</p> <p>Logged by: E. Eckles</p>	

Test Pit Logs

Project No: 22-232
 Project Name: Shadowood Water System Improvements
 Project Location: 131 SE Sunrise Drive, Shelton, WA 98584
 Excavated: 6/21/2022

Infiltration Pit No. IT-2	
Location: 47.1698482168508, -123.06689658335411 (WGS84)	
Approximate ground surface elevation: 178 feet (NAVD88)	
<u>Depth (ft)</u>	<u>Material Description</u>
0 – 1	Organics, topsoil, and forest duff [Topsoil]
1 – 4	Loose to medium dense, tan to brown, silty SAND to sandy SILT with trace gravel; moist, very fine to fine sand, fine rounded gravel, massive soil structure [Weathered Colluvium]
	
<p>Image of soils encountered approximately 4-feet below the existing ground surface (bgs). Groundwater was not encountered at the time of exploration. No soil caving or other indications of excavation instability were observed. A soil sample was collected at 4-feet bgs.</p> <p>Logged by: E. Eckles</p>	

APPENDIX C

PERMITS



Mason County

Mason County - Division of Community Development

615 W. Alder St.
Building 8
Shelton, WA 98584
360-427-9670 ext 352
www.masoncountywa.gov

GRD2024-00004

GRADING

PROJECT DESCRIPTION: GRADING PERMIT
SITE ADDRESS: 131 SE SUNRISE DR SHELTON

ISSUED: 01/22/2025
EXPIRES: 07/21/2025

PARCEL: 319045700086

APPLICANT: MASON COUNTY PUD #1
21917 N US HIGHWAY 101
SHELTON, WA 98584
1.360.877.5249 X202

OWNER: SHADOWOOD HOMEOWNERS ASSN QCD
131 SE SUNRISE DR
SHELTON, WA 98584

FEES:	<u>Paid</u>	<u>Due</u>
Grading Plan Review Fees	\$194.00	\$0.00
Planning Commercial Review Fee	\$450.00	\$0.00
Planning Stormwater Review	\$300.00	\$0.00
Grading Permit Fee	\$291.00	\$0.00
Totals :	\$1,235.00	\$0.00

REQUIRED INSPECTIONS

3rd Party Inspection Report

BLD-Final Inspection

CONDITIONS

* Access Roads to the site must not be degraded as a result of work.

* ALL CLEARING, CUTTING, GRADING, EXCAVATING, TERRACING, FILLING AND SIMILIAR WORK WILL BE REGULATED BY THE REQUIREMENTS PURSUANT TO THE MASON COUNTY GRADING PERMIT STANDARDS ADOPTED BY RESOLUTION 141-96 and MASON COUNTY CODE, TITLE 14, CHAPTER 14.44.

* Provisions for surface/subsurface drainage control must be implemented with new construction or development on site and MUST NOT adversely impact adjacent parcels. Under the requirements of Mason County Stormwater Ordinance, either private ditches and drains will meet requirements of the stormwater ordinance or prior approval will be granted to use an existing utility and drainage easement dedicated for that specific purpose. For further information regarding this ordinance contact the Mason County Public Works Department prior to construction at Ext 450



Mason County
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GRADING GRD2024-00004

* OWNER / BUILDER acknowledges submission of inaccurate information may result in a stop work order or permit revocation. Acknowledgement of such is by signature below. I declare that I am the owner, owners legal representative, or contractor. I further declare that I am entitled to receive this permit and to do the work as proposed. I have obtained permission from all the necessary parties, including any easement holder or parties of interest regarding this project. The owner or authorized agent represents that the information provided is accurate and grants employees of Mason County access to the above described property and structure(s) for review and inspection. This permit/application becomes null & void if work or authorized construction is not commenced within 180 days or if construction work is suspended for a period of 180 days. PROOF OF CONTINUATION OF WORK IS BY MEANS OF INSPECTION. INACTIVITY OF THIS PERMIT APPLICATION OF 180 DAYS WILL INVALIDATE THE APPLICATION UNLESS OTHERWISE APPROVED.

* All other necessary permits from Mason County, Washington State, Federal Agencies, and/or other agencies/groups that are required for this proposed development and construction must be obtained PRIOR TO DEVELOPMENT AND CONSTRUCTION.

* All culverts shall be maintained in perpetuity to ensure that drainage will not overflow.

* All fills shall be compacted to a minimum of 90 percent of maximum density. Unless noted otherwise by engineer or geo-report

* A 20 foot wide fire apparatus access road is required to extend within 150 feet of any portion of the exterior walls of the building. An unobstructed vertical clearance of 13 feet, 6 inches is required. Dead-end fire apparatus access roads longer than 150 feet are required to have an approved turnaround. The maximum grade of a fire apparatus access road is 14%.

* Cut and fill slopes shall be setback from site boundaries in accordance with Section 14.44.190. Unless noted otherwise by engineer or geo-report

* Compliance with an approved Storm Water Plan shall be subject to an on site inspection, or inspections, by the engineer of record or an authorized representative. Said inspection(s) shall be performed in accordance with the approved plan, and prior to any modification that would make a determination of compliance impossible. Inspection reports shall be submitted to verify all engineering requirements have been completed in accordance with the approved storm water plan. Reports shall be submitted to the Mason County Department of Community Development prior to each corresponding inspection and final permit approval. Copies of all special inspection reports shall be made available at time of inspection.

* Retaining walls needed to support a surcharge such as structures, roads, or to support slopes, shall require a separate building permit and approval prior to construction of the retaining wall.

* The owner / applicant shall provide to Mason County inspection reports prepared by the engineer record, complying with the requirements as noted in Chapter 14.44, section 14.44.220 through 14.44.230.

* ALL SURFACE WATER AND POTENTIAL RUNOFF WILL BE CONTROLLED ON SITE AND SHALL NOT ADVERSLY AFFECT ANY ADJACENT PROPERTIES NOR INCREASE THE VELOCITY FLOW ENTERING OR ABUTTING TO ANY STATE OR COUNTY CULVERTING/DITCHING SYSTEM OR ROAD WAY

* All construction must meet or exceed all local and state ordinances in addition to the International Codes requirements as adopted and amended by Mason County and the State of Washington. Occupancy is limited to the approved and permitted classification. Any non-approved change of use or occupancy would result in permit revocation.

* All RED stamped approved plans are required to be on-site for inspection purposes. If an inspection is called for and plans are not available on site, then approval will not be granted. In addition, a re-inspection fee (refer to current fee schedule, minimum 1 hour) will be charged and must be collected by the Building Department prior to any further inspections being performed or approvals granted.



Mason County

Mason County - Division of Community Development

615 W. Alder St.
Building 8
Shelton, WA 98584
360-427-9670 ext 352
www.masoncountywa.gov

GRADING GRD2024-00004

* When parcel development requires direct access to county road(s), a Road Access Permit or Approval must be granted by the Mason County Department of Public Works. For any construction which is proposed to be located within 25' of a Mason County road right of way, it is suggested to contact that office to review future planned work which may affect your project. For more information contact Public Works, at (360) 427-9670, ext. 450 or 100 W Public Works Dr. Shelton. The building permit will not be finalized until the permit holder can show proof that the access permit from Public Works has been finalized and approved.

* Any changes in proposed construction shall be reviewed by the engineer or architect of record and submitted in writing to the Mason County Building Department prior to construction. All engineering and/or architectural documents are a part of the approved set of plans and shall remain attached thereto. If documents are removed, approval will not be granted. In addition, a re-inspection fee (refer to current fee schedule, minimum 1 hour) will be charged and shall be collected by the Building Department prior to any further inspections being performed or approvals granted.

* CONSTRUCTION PROCESS TO BE FIELD CORRECTED AS REQUIRED PER MASON COUNTY BUILDING DEPARTMENT AND THE ADOPTED BUILDING CODE.

The construction of the permitted project is subject to inspections by the Mason County Building Department. All construction must be in conformance with the international codes as amended and adopted by Mason County. Any corrections, changes or alterations required by a Mason County Building Inspector shall be made prior to requesting additional inspections.

* All building permits shall have a final inspection performed and approved by Mason County Building Department prior to permit expiration. The failure to request a final inspection or to obtain approval will be documented in the legal property records on file with Mason County as being non-compliant with Mason County ordinances and building regulations.

* Fuel piping shall be inspected after the installation of fuel piping is complete, and before the attachment of fixtures, appliances, or shut-off valves. At the time of inspection the test pressure shall be no less than the pressures specified by the IRC, IFGC or other applicable Code/s and manufactures specifications. Appliances to be attached to the fuel piping system shall not be used until the final inspection has been performed and approved by a Mason County building inspector.

* All permits expire 180 days after permit issuance, or 180 days after the last inspection activity is performed. The Building Official may grant one or more extension of 180 days, upon the receipt of a written extension request prior to permit expiration. Letter must indicate that circumstances beyond the control of the permit holder prevented action from being taken.

* Owner/applicant must obtain a separate permit for the placement of any size propane tank serving a fixed appliance within a permitted structure or unit prior to the placement of the tank.

* All property lines shall be clearly identified at the time of foundation inspection.

* Contractor registration laws are governed under RCW 18.27 and enforced by the WA State Dept of Labor and Industries, Contractor Compliance Division. There are potential risks and monetary liabilities to the homeowner for using an unregistered contractor. Further information can be obtained at 1-800-647-0982. The person signing this condition is either the homeowner, agent for the owner or a registered contractor according to WA state law.

* Approved per site plan and topographic cross-section.

* The stamped approved site plan is required to be on-site for inspection purposes. If an inspection is requested and the approved site plan is not on site, approval will not be granted. In addition, a re-inspection fee (refer to current fee schedule, minimum 1 hour) will be charged and shall be collected by the Building Department prior to any further inspections being performed or approvals granted.



Mason County
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GRADING GRD2024-00004

I hereby certify that I have read and examined this application and know the same to be true and correct. All provisions of Laws and Ordinances governing this type of work will be complied with whether specified herein or not. The granting of a permit does not presume to give authority to violate or cancel the provisions of any other state/local law regulating construction or the performance of construction.

Issued By: Gene

Contractor or Authorized Agent: Bronly Wilcox Date: 1/22/2025



MASON COUNTY COMMUNITY SERVICES

Building, Planning, Environmental Health, Community Health

615 W. Alder St. Bldg 8, SHELTON, WA 98584

SHELTON: 360-427-9670, EXT 352

BELFAIR: 360-275-4467, EXT 352

ELMA: 360-482-5269, EXT 352

www.co.mason.wa.us

INSPECTION CARD AND CERTIFICATE OF OCCUPANCY**

To schedule an inspection call or visit <http://www.co.mason.wa.us/community-services/bld-inspection.php>

Permit Number	GRD2024-00004	Date Issued	01/22/2025	Issued By	<i>Jenice</i>
Project	GRADING PERMIT				
Site Address	131 SE SUNRISE DR				
Applicant	MASON COUNTY PUD #1				
Contractor					
Contractor Phone					
Primary Code	2018 IBC, IRC, IFC, IEC, IMC, & UPC	Type			
Permit Type	GRADING	Occupancy			

- APPROVED PLANS MUST BE ONSITE FOR ALL INSPECTIONS.
- DO NOT PROCEED BEYOND EACH STAGE OR COVER WORK UNTIL APPROVAL IS GRANTED.
- THIS CARD MUST BE POSTED IN A CONSPICUOUS LOCATION, FRONT OF THE PREMISES IS BEST FOR MAKING ENTRY.
- ALL PERMITS EXPIRE 180 DAYS AFTER THE PERMIT IS ISSUED OR 180 DAYS AFTER DATE OF LAST INSPECTION.
- OWNER/AGENT IS RESPONSIBLE FOR REQUESTING ALL INSPECTIONS THROUGH FINAL INSPECTION.

****THIS STRUCTURE MAY NOT BE USED OR OCCUPIED UNTIL ALL APPROVALS ARE GRANTED.****
PRIOR TO CALLING FOR FINAL INSPECTION, ALL CONDITIONS OF THE PERMIT MUST BE MET

Public Works	Access/Driveway	Other
Health Department	Septic	Well
Planning Department	Site Inspection	
Fire Marshall	Fire Apparatus Access	Fire Sprinkler
	Auto Fire Alarm	Hood and Duct
	Other	Final
Building Department	Building Official: Community Services Designee	
Concrete	Setbacks	Slab
	Footing Perimeter	Point load Footing
	Footing Interior	Footing Decks / Porches
	Foundation Stem Walls	Other
Rough-In	Groundwork Plumbing	Framing
	Groundwork Mechanical	Plumbing
	Groundwork Gas Pipe	Mechanical
	Gas Piping	Shear Wall Nailing
	Underfloor	
	Other	
Insulation	Slab	Ceiling
	Floor	Vaulted Ceiling
	Walls	Vapor Barrier
	Other	
Wallboard Nailing	Interior Wall Brace Panels	Fire Walls
	Other	
Final Building		
Manufactured Home	Setbacks	Setup
	Concrete Foot / Runners	Final
	Other	



Mason County

Mason County - Division of Community Development

615 W. Alder St.
Building 8
Shelton, WA 98584
360-427-9670 ext 352
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NEW COMMERCIAL PERMIT COM2024-00072

* Provisions for surface/subsurface drainage control must be implemented with new construction or development on site and MUST NOT adversely impact adjacent parcels. Under the requirements of Mason County Stormwater Ordinance, either private ditches and drains will meet requirements of the stormwater ordinance or prior approval will be granted to use an existing utility and drainage easement dedicated for that specific purpose. For further information regarding this ordinance contact the Mason County Public Works Department prior to construction at Ext 450

* All other necessary permits from Mason County, Washington State, Federal Agencies, and/or other agencies/groups that are required for this proposed development and construction must be obtained PRIOR TO DEVELOPMENT AND CONSTRUCTION.

* Contractor registration laws are governed under RCW 18.27 and enforced by the WA State Dept of Labor and Industries, Contractor Compliance Division. There are potential risks and monetary liabilities to the homeowner for using an unregistered contractor. Further information can be obtained at 1-800-647-0982. The person signing this condition is either the homeowner, agent for the owner or a registered contractor according to WA state law.

* REQUIREMENTS FOR ROOF COVERINGS. Roof coverings shall be applied in accordance with the applicable provisions of the current code and the manufacturer's installation instructions.

A drip edge shall be provided at eaves and gables of shingle roofs.

* All permits expire 180 days after permit issuance, or 180 days after the last inspection activity is performed. The Building Official may grant one or more extension of 180 days, upon the receipt of a written extension request prior to permit expiration. Letter must indicate that circumstances beyond the control of the permit holder prevented action from being taken.

* The international code requires a fire apparatus access road for every facility, building, or portion of a building that is more than 150' from an approved access road. Roads are required to meet the minimum Mason County Fire Marshal standards for Fire Apparatus Access Roads up to the point where such roads connect with a county maintained public road or to another fire apparatus access road which connects to a county maintained public road.

* CONSTRUCTION PROCESS TO BE FIELD CORRECTED AS REQUIRED PER MASON COUNTY BUILDING DEPARTMENT AND THE ADOPTED BUILDING CODE.

The construction of the permitted project is subject to inspections by the Mason County Building Department. All construction must be in conformance with the international codes as amended and adopted by Mason County. Any corrections, changes or alterations required by a Mason County Building Inspector shall be made prior to requesting additional inspections.

* All changes to "approved" building plans that effect compliance with the international codes as amended and adopted, or any other Mason County ordinance or regulation, must be reviewed and approved by Mason County prior to construction.

* Must comply with all Washington State DOH Drinking Water regulations.

* Any changes in proposed construction shall be reviewed by the engineer or architect of record and submitted in writing to the Mason County Building Department prior to construction. All engineering and/or architectural documents are a part of the approved set of plans and shall remain attached thereto. If documents are removed, approval will not be granted. In addition, a re-inspection fee (refer to current fee schedule, minimum 1 hour) will be charged and shall be collected by the Building Department prior to any further inspections being performed or approvals granted.



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NEW COMMERCIAL PERMIT COM2024-00072

* In addition to the inspections required in IBC, Section 110, the owner, the engineer or architect of record acting as the owner's agent shall employ one or more special inspectors who shall provide inspections during construction on the types of work listed under Chapter 17 and as specified by the design professional. The special inspectors duties & responsibilities shall be as specified in Chapter 17.

Special inspection reports shall be submitted to the Mason County Building Department, 615 W Alder St, Shelton WA 98584 and available for inspection. Inspection reports shall be completed and submitted to the dept. in a timely manner and shall be submitted prior to the framing and final occupancy inspections.

SPECIAL INSPECTION REQUIRED FOR THE FOLLOWING:

- SOIL COMPACTION
- CONCRETE (TESTING AND PLACEMENT)
- WOOD CONSTRUCTION

SEE PLANS SHEET S-1, S-2, AND SILO DRAWING DR-10779-SD-6020 FOR REQUIREMENTS.

* COUNTY INSPECTION REQUIRED. APPROVALS MUST BE GRANTED PRIOR TO MOVING TO THE NEXT PHASE OF CONSTRUCTION. CONTACT THE BUILDING DEPARTMENT TO DISCUSS ALL INSPECITON REQUIREMENTS.

I hereby certify that I have read and examined this application and know the same to be true and correct. All provisions of Laws and Ordinances governing this type of work will be complied with whether specified herein or not. The granting of a permit does not presume to give authority to violate or cancel the provisions of any other state/local law regulating construction or the performance of construction.

Issued By: Genie

Contractor or Authorized Agent: Bronly Wilkey Date: 1/22/2025



MASON COUNTY COMMUNITY SERVICES

Building, Planning, Environmental Health, Community Health

615 W. Alder St. Bldg 8, SHELTON, WA 98584

SHELTON: 360-427-9670, EXT 352

BELFAIR: 360-275-4467, EXT 352

ELMA: 360-482-5269, EXT 352

www.co.mason.wa.us

INSPECTION CARD AND CERTIFICATE OF OCCUPANCY**

To schedule an inspection call or visit <http://www.co.mason.wa.us/community-services/bld-inspection.php>

Permit Number	COM2024-00072	Date Issued	01/22/2025	Issued By	<i>Jemie</i>
Project	NEW 90,000 GALLON CONCRETE RESERVOIR				
Site Address	131 SE SUNRISE DR				
Applicant	MASON COUNTY PUD #1				
Contractor					
Contractor Phone					
Primary Code	2018 IBC, IRC, IFC, IEC, IMC, & UPC	Type			
Permit Type	NEW COMMERCIAL PERMIT	Occupancy			

- APPROVED PLANS MUST BE ONSITE FOR ALL INSPECTIONS.
- DO NOT PROCEED BEYOND EACH STAGE OR COVER WORK UNTIL APPROVAL IS GRANTED.
- THIS CARD MUST BE POSTED IN A CONSPICUOUS LOCATION, FRONT OF THE PREMISES IS BEST FOR MAKING ENTRY.
- ALL PERMITS EXPIRE 180 DAYS AFTER THE PERMIT IS ISSUED OR 180 DAYS AFTER DATE OF LAST INSPECTION.
- OWNER/AGENT IS RESPONSIBLE FOR REQUESTING ALL INSPECTIONS THROUGH FINAL INSPECTION.

****THIS STRUCTURE MAY NOT BE USED OR OCCUPIED UNTIL ALL APPROVALS ARE GRANTED.****
PRIOR TO CALLING FOR FINAL INSPECTION, ALL CONDITIONS OF THE PERMIT MUST BE MET

Public Works	Access/Driveway	Other
Health Department	Septic	Well
Planning Department	Site Inspection	
Fire Marshall	Fire Apparatus Access	Fire Sprinkler
	Auto Fire Alarm	Hood and Duct
	Other	Final
Building Department	Building Official: Community Services Designee	
Concrete	Setbacks	Slab
	Footing Perimeter	Point load Footing
	Footing Interior	Footing Decks / Porches
	Foundation Stem Walls	Other
Rough-In	Groundwork Plumbing	Framing
	Groundwork Mechanical	Plumbing
	Groundwork Gas Pipe	Mechanical
	Gas Piping	Shear Wall Nailing
	Underfloor	
	Other	
Insulation	Slab	Ceiling
	Floor	Vaulted Ceiling
	Walls	Vapor Barrier
	Other	
Wallboard Nailing	Interior Wall Brace Panels	Fire Walls
	Other	
Final Building		
Manufactured Home	Setbacks	Setup
	Concrete Foot / Runners	Final
	Other	



Mason County
Mason County - Division of Community Development

615 W. Alder St.
 Building 8
 Shelton, WA 98584
 360-427-9670 ext 352
 www.masoncountywa.gov

COM2024-00074

NEW COMMERCIAL PERMIT

PROJECT DESCRIPTION: BOOSTER STATION & TREATMENT BLDG
SITE ADDRESS: 131 SE SUNRISE DR SHELTON

ISSUED: 01/22/2025
EXPIRES: 07/21/2025

PARCEL: 319045700086

APPLICANT: MASON COUNTY PUD #1
 21917 N US HIGHWAY 101
 SHELTON, WA 98584
 1.360.877.5249 X202

OWNER: SHADOWOOD HOMEOWNERS ASSN QCD
 131 SE SUNRISE DR
 SHELTON, WA 98584

VALUATIONS:			FEES:		
				<u>Paid</u>	<u>Due</u>
Project Valuation (BID, ESTIMATION..)	545000.00	\$545,000.00	Building Permit Fee	\$3,786.80	\$0.00
			Pre-application meeting - Major EH Plan Review	\$265.00	\$0.00
			Technology Surcharge	\$124.96	\$0.00
			Planning Commercial Review Fee	\$450.00	\$0.00
			State Fee-Commercial	\$25.00	\$0.00
			Plan Check Fee	\$2,461.42	\$0.00
			IFC Plan Check Fee	\$500.00	\$0.00
			Totals :	\$7,613.18	\$0.00
	Total:	\$545,000.00			

REQUIRED INSPECTIONS

Setback Inspection	Insulation Inspection
Footing Inspection	Connection is to be verified by Health or Utilities
Shearwall Inspection	KNOX BOX VERIFICATION
Framing Inspection	BLD-Final Inspection
Rough- Plumbing Inspection	3rd Party Inspection Report
Mechanical Inspection	



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NEW COMMERCIAL PERMIT COM2024-00074

CONDITIONS

- * Contractor registration laws are governed under RCW 18.27 and enforced by the WA State Dept of Labor and Industries, Contractor Compliance Division. There are potential risks and monetary liabilities to the homeowner for using an unregistered contractor. Further information can be obtained at 1-800-647-0982. The person signing this condition is either the homeowner, agent for the owner or a registered contractor according to WA state law.
- * All surface water and potential runoff must be controlled on site and shall not adversely affect any adjacent properties nor increase the velocity flow entering or abutting to any state or county culverting/ditching system or road way.
- * Owner / Agent is responsible to post the assigned address and/ or purchase and post private road signs in accordance with Mason County Code 14.28 and 14.17.
- * All permits expire 180 days after permit issuance, or 180 days after the last inspection activity is performed. The Building Official may grant one or more extension of 180 days, upon the receipt of a written extension request prior to permit expiration. Letter must indicate that circumstances beyond the control of the permit holder prevented action from being taken.
- * The foundation/footing must be placed on undisturbed, firm-native soil. Proper frost depth, minimum 12 inches, shall be observed below grade in undisturbed soils.
- * All property lines shall be clearly identified at the time of foundation inspection.
- * The international code requires a fire apparatus access road for every facility, building, or portion of a building that is more than 150' from an approved access road. Roads are required to meet the minimum Mason County Fire Marshal standards for Fire Apparatus Access Roads up to the point where such roads connect with a county maintained public road or to another fire apparatus access road which connects to a county maintained public road.
- * Disclaimer: Mason County does not require a survey to obtain a building permit. As a result, site plans may not reflect accurate data. It is the applicant's responsibility to comply with setback requirements.
- * The stamped approved site plan is required to be on-site for inspection purposes. If an inspection is requested and the approved site plan is not on site, approval will not be granted. In addition, a re-inspection fee (refer to current fee schedule, minimum 1 hour) will be charged and shall be collected by the Building Department prior to any further inspections being performed or approvals granted.
- * By definition, propane tanks and heatpumps are structures, which must meet setback conditions. Please check your "Approved Site Plan" to ensure these structures meet the setback conditions listed.
- * All other necessary permits from Mason County, Washington State, Federal Agencies, and/or other agencies/groups that are required for this proposed development and construction must be obtained PRIOR TO DEVELOPMENT AND CONSTRUCTION.
- * All RED stamped approved plans are required to be on-site for inspection purposes. If an inspection is called for and plans are not available on site, then approval will not be granted. In addition, a re-inspection fee (refer to current fee schedule, minimum 1 hour) will be charged and must be collected by the Building Department prior to any further inspections being performed or approvals granted.
- * Provisions for surface/subsurface drainage control must be implemented with new construction or development on site and MUST NOT adversely impact adjacent parcels. Under the requirements of Mason County Stormwater Ordinance, either private ditches and drains will meet requirements of the stormwater ordinance or prior approval will be granted to use an existing utility and drainage easement dedicated for that specific purpose. For further information regarding this ordinance contact the Mason County Public Works Department prior to construction at Ext 450
- * WIND LOADS - Roof coverings shall be designed and tested to withstand the maximum basic wind speed. The basic wind speed for Mason County is 85 mph with 110 mph gust factor.



Mason County

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NEW COMMERCIAL PERMIT COM2024-00074

* All construction must meet or exceed all local and state ordinances in addition to the International Codes requirements as adopted and amended by Mason County and the State of Washington. Occupancy is limited to the approved and permitted classification. Any non-approved change of use or occupancy would result in permit revocation.

* Approved per dimensions and setbacks on submitted site plan. Setbacks are measured from the farthest projection of the structure. Front setbacks are measured from the front lot line or road easement boundary, whichever is closer.

* CONSTRUCTION PROCESS TO BE FIELD CORRECTED AS REQUIRED PER MASON COUNTY BUILDING DEPARTMENT AND THE ADOPTED BUILDING CODE.

The construction of the permitted project is subject to inspections by the Mason County Building Department. All construction must be in conformance with the international codes as amended and adopted by Mason County. Any corrections, changes or alterations required by a Mason County Building Inspector shall be made prior to requesting additional inspections.

* REQUIREMENTS FOR ROOF COVERINGS. Roof coverings shall be applied in accordance with the applicable provisions of the current code and the manufacturer's installation instructions.

A drip edge shall be provided at eaves and gables of shingle roofs.

* All changes to "approved" building plans that effect compliance with the international codes as amended and adopted, or any other Mason County ordinance or regulation, must be reviewed and approved by Mason County prior to construction.

* All building permits shall have a final inspection performed and approved by Mason County Building Department prior to permit expiration. The failure to request a final inspection or to obtain approval will be documented in the legal property records on file with Mason County as being non-compliant with Mason County ordinances and building regulations.

* Must comply with all Washington State DOH Drinking Water regulations.

* Any changes in proposed construction shall be reviewed by the engineer or architect of record and submitted in writing to the Mason County Building Department prior to construction. All engineering and/or architectural documents are a part of the approved set of plans and shall remain attached thereto. If documents are removed, approval will not be granted. In addition, a re-inspection fee (refer to current fee schedule, minimum 1 hour) will be charged and shall be collected by the Building Department prior to any further inspections being performed or approvals granted.

* In addition to the inspections required in IBC, Section 110, the owner, the engineer or architect of record acting as the owner's agent shall employ one or more special inspectors who shall provide inspections during construction on the types of work listed under Chapter 17 and as specified by the design professional. The special inspectors duties & responsibilities shall be as specified in Chapter 17.

Special inspection reports shall be submitted to the Mason County Building Department, 615 W Alder St, Shelton WA 98584 and available for inspection. Inspection reports shall be completed and submitted to the dept. in a timely manner and shall be submitted prior to the framing and final occupancy inspections.

SPECIAL INSPECTION REQUIRED FOR THE FOLLOWING:

- SOIL COMPACTION
- CONCRETE (TESTING AND PLACEMENT)
- WOOD CONSTRUCTION

SEE PLANS SHEET S-1, S-2, AND SILO DRAWING DR-10779-SD-6020 FOR REQUIREMENTS.

* COUNTY INSPECTION REQUIRED. APPROVALS MUST BE GRANTED PRIOR TO MOVING TO THE NEXT PHASE OF CONSTRUCTION. CONTACT THE BUILDING DEPARTMENT TO DISCUSS ALL INSPECITON REQUIREMENTS.



Mason County

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NEW COMMERCIAL PERMIT COM2024-00074

I hereby certify that I have read and examined this application and know the same to be true and correct. All provisions of Laws and Ordinances governing this type of work will be complied with whether specified herein or not. The granting of a permit does not presume to give authority to violate or cancel the provisions of any other state/local law regulating construction or the performance of construction.

Issued By: Genie

Contractor or Authorized Agent: Bradley Miller Date: 1/22/2025



MASON COUNTY COMMUNITY SERVICES

Building, Planning, Environmental Health, Community Health

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INSPECTION CARD AND CERTIFICATE OF OCCUPANCY**

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Permit Number	COM2024-00074	Date Issued	01/22/2025	Issued By	<i>Jenni</i>
Project	BOOSTER STATION & TREATMENT BLDG				
Site Address	131 SE SUNRISE DR				
Applicant	MASON COUNTY PUD #1				
Contractor					
Contractor Phone					
Primary Code	2018 IBC, IRC, IFC, IEC, IMC, & UPC	Type			
Permit Type	NEW COMMERCIAL PERMIT	Occupancy			

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- ALL PERMITS EXPIRE 180 DAYS AFTER THE PERMIT IS ISSUED OR 180 DAYS AFTER DATE OF LAST INSPECTION.
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PRIOR TO CALLING FOR FINAL INSPECTION, ALL CONDITIONS OF THE PERMIT MUST BE MET

Public Works	Access/Driveway	Other
Health	Septic	Well
Department		
Planning	Site Inspection	
Department		
Fire Marshall	Fire Apparatus Access	Fire Sprinkler
	Auto Fire Alarm	Hood and Duct
	Other	Final
Building Department	Building Official: Community Services Designee	
Concrete	Setbacks	Slab
	Footing Perimeter	Point load Footing
	Footing Interior	Footing Decks / Porches
	Foundation Stem Walls	Other
Rough-In	Groundwork Plumbing	Framing
	Groundwork Mechanical	Plumbing
	Groundwork Gas Pipe	Mechanical
	Gas Piping	Shear Wall Nailing
	Underfloor	
	Other	
Insulation	Slab	Ceiling
	Floor	Vaulted Ceiling
	Walls	Vapor Barrier
	Other	
Wallboard Nailing	Interior Wall Brace Panels	Fire Walls
	Other	
Final Building		
Manufactured Home	Setbacks	Setup
	Concrete Foot / Runners	Final
	Other	



MASON COUNTY
COMMUNITY SERVICES

Special Inspection Requirements

Permit Number	Project Title	Project Address/Parcel Number
<p>Applicants of projects requiring Special Inspection or Testing per Chapter 1704 & 1705 of the International Building Code, as amended by Washington State. Please acknowledge and return this form to the Mason County Permit Center.</p>		

THESE INSPECTIONS ARE NOT PERFORMED BY THE BUILDING DEPARTMENT AND MUST BE PERFORMED BY QUALIFIED SPECIAL INSPECTORS, HIRED BY THE OWNER AND APPROVED BY THE COUNTY PERMIT CENTER. Individuals certified in a special inspection category by *Washington Association of Building officials (WABO)* or individuals employed by a recognized testing laboratory and under the direct supervision of a Registered Professional Engineer are typically considered qualified at the discretion of the local jurisdiction having authority for enforcement.

BEFORE A PERMIT CAN BE ISSUED: The Owner or his/her representative, on the advice of the responsible Project Engineer or Architect, shall fill out completely, sign and submit two (2) copies of the attached "Structural Tests and Inspection Schedule" to this Department for review and approval including any requirements related to the Mason County Municipal Code.

The Owner, General Contractor, and Inspection/Testing Agency, where applicable, shall also acknowledge the following conditions applicable to Special Inspection and/or Testing.

1. Inspection/Testing Agency shall submit names and qualifications of on-site Special Inspectors to the Building Inspection Permit Center for approval **PRIOR TO PERMIT/S BEING ISSUED.**
2. All Special Inspections shall be noted on the approved plans or attached approved documents.
3. All special inspections shall be approved by the County or as recommended by the Engineer of Record (EOR).
4. It is the responsibility of the General Contractor to review County approved plans for additional inspection or testing requirements that may be noted or required per IBC as noted on approved plans.
5. The General Contractor is responsible for proper notification to the **Inspection/Testing Agency** for items listed on this form.
6. Special Inspectors shall provide detailed reports on company letterhead to the Building Inspector of all required inspection activities. These may also be provided when the inspector visits the jobsite for the scheduled inspection but must be completed before the subject of inspection is approved by the building inspector.
7. Copies of all ongoing laboratory and testing reports shall be sent directly to the Building Inspector by the Inspection/Testing Agency or other responsible party within a reasonable time to test results.
8. **BEFORE A CERTIFICATE OF OCCUPANCY APPROVAL CAN BE ISSUED:** The Inspection/Testing Agency shall submit a **FINAL REPORT LETTER** stating that all items requiring testing and inspection have been fulfilled and reported and a final inspection report shall be provided. A copy of the statement is to be maintained at the jobsite for the Building Inspectors review prior to final inspections.



Special Inspection Requirements

ACKNOWLEDGEMENTS

Prior to issuance of a building permit, the Owner, on the advice of the Project Engineer or Architect, shall complete, sign, and submit this form to the County Permit Center.

Declaration of Owner

I, as the owner of the project, declare that the testing agency firm/s or individual/s listed herein are hired by me to perform “Special Inspections” and/or “Structural Testing” in accordance with the provisions of the International Building code (IBC) Chapter 17.

Owner (print)

Owner (Signature) (date)

Declaration of Registered Professional Architect/Engineer

I, as the design professional in responsible charge of the project listed herein, declare that the special inspection listed herein are required for this project in accordance with the provisions of the International Building Code (IBC) Chapter 17.

Architect/Engineer (print)

Architect/Engineer Stamp/Signature (date)



Testing Agency Name/Contact info:

The Special Inspection/Testing Agency listed above must have a current Portfolio of Qualifications on file with the County prior to performing work.

Declaration of the General Contractor

I, as the General Contractor of the project, agree to comply with the “Contractor Responsibility” items noted herein.

General Contractor (print)

General Contractor Signature (date)



Special Inspection Requirements

Required Special Inspections International Building Code; Chapter 17:

A completed and signed copy of pages **1 through 4** of this form shall be submitted to the "Permit Center" prior to building permit approval.

Engineer shall check the applicable items:

- Special inspection of fabricated items 1704.2.5
- Submittals to the building official 1704.5
- Structures over 75' in height located in Seismic Design Category D, 1704.6.1
- Structures classified as Risk Category III or IV located in Seismic Design Category D, 1704.6.1

- Steel construction & structural Steel 1705.2.1
- Cold form steel deck 1705.2.2
- Open-web steel joists & girders 1705.2.3
- Cold form steel trusses spanning 60 feet or greater 1705.2.4

- Concrete construction 1705.3 & Table 1705.3**
- Shotcrete 1705.3

- Welding of reinforcing bars 1705.3.1
- Material Tests 1705.3.2
- Masonry Construction 1705.4
- Empirically designed masonry, glass unit & masonry in Risk Category IV 1705.4.1
- Vertical masonry foundation elements 1705.4.2

- Wood construction 1705.5**
- High Load Diaphragms 1705.5.1
- Metal-plate connected wood trusses spanning 60 feet or greater 1705.5.2

- Soils 1705.6 & Table 1705.6**
- Driven deep foundations 1705.7 & Table 1705.7
- Cast in-place deep foundations 1705.8 & Table 1705.8
- Helical pile foundations 1705.9
- Fabricated items 1705.10



Special Inspection Requirements

- Special inspections for wind resistance 1705.11
 - Structural wood 1705.11.1
 - Wind resisting components 1705.11.3
 - Cold formed steel light frame 1705.11.2

- Special inspection for seismic resistance 1705.12
 - Special inspection for structural steel per 1705.12.1
 - Seismic force-resisting systems 1705.12.1.1
 - Structural steel elements 1705.12.1.2
 - Special inspection for structural wood per 1705.12.2
 - Special inspection for cold-formed steel per 1705.12.3

- Designated seismic systems 1705.12.4
- Architectural components 1705.12.5
- Plumbing, mechanical & electrical components 1705.12.6
- Storage racks 1705.12.7
- Seismic isolation systems 1705.12.8
- Cold-formed steel special bolted moment frames 1705.12.9
- Testing for seismic resistance 1705.13
 - Structural steel 1705.13.1
 - Seismic fore-resisting systems 1705.13.1.1
 - Structural steel elements 1705.13.1.2
- Nonstructural components 1705.13.2
- Designated seismic systems 1705.13.3
- Seismic isolation systems 1705.13.4
- Sprayed fire-resistance materials 1705.14
 - Physical and visual tests 1705.14.1
 - Structural member surface conditions 1705.14.2 (1705.14.3 through 1705.14.6.3)
- Mastic & intumescent fire-resistance coatings 1705.15
- Exterior insulation & finish systems (EIFS) 1705.16
- Fire-resistance penetrations and joints 1705.17
 - Penetration firestops 1705.17.1
 - Fire-resistant joint systems 1705.17.2
- Testing for smoke control 1705.18
 - Testing Scope 1705.18.1