CONSTRUCTION DOCUMENTS

JUDY WATER TREATMENT PLANT
W1 PUMP SYSTEM REPLACEMENT PROJECT

Project # 3793
C.O. # 5066

Issued for Bid

March 19, 2025

DISTRICT OFFICE
1415 Freeway Drive
Mount Vernon, WA 98273
(360) 424-7104 -- Telephone

DISTRICT OFFICIALS

Commission
Andrew Miller, President
Corrin Hamburg, Vice President
Joe Lindquist, Secretary

General Manager
George Sidhu, P.E.

Engineering Manager
Mark C. Handzlik, P.E.

Operations Manager
Mike Fox

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CERTIFICATIONS PAGE

W1 PUMP SYSTEM REPLACEMENT PROJECT

These specifications and design drawings for the **W1 Pump System Replacement Project** have been prepared under the direction of the following Registered Professional Engineers.

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INVITATION TO BID

INVITATION TO BID

Notice is hereby given that Public Utility District No. 1 of Skagit County (Skagit PUD) will receive sealed Bids for the **W1 Pump System Replacement Project.** Each bid shall be placed in a sealed envelope and shall be mailed or delivered to Skagit PUD's office, Attn: Catherine Price, Contract Coordinator, 1415 Freeway Drive, Mount Vernon, Washington 98273, to arrive no later than 10:00 AM, April 9, 2025. All complete bids will be opened and publicly read immediately following.

W1 Pump System Replacement Project

Installation of a new pump system at the Judy Reservoir Water Treatment Plant to replace the existing W1 pump system. The new pump system will include three pumps, motors, motor control centers, VFD control systems, flow meter, bladder pressure tanks, mechanical appurtenances and modifications, and electrical equipment. Portions of the existing W1 pump system will need to be maintained during the installation of the new pump system to achieve continuity of service throughout the project.

The location of the proposed work is shown on the project plans.

A Pre-Bid Meeting will be held at 1:30 PM on April 1, 2025, at the project site, located at 12115 Morford Road, Sedro-Woolley, Washington.

An unofficial bid set can be viewed on PUD's website www.SkagitPUD.org, or at Skagit PUD's office located at 1415 Freeway Drive, Mount Vernon, Washington 98273. Construction plans, specifications, addenda, and plan holders list for this project can be viewed or purchased on-line through Builders Exchange of Washington, Inc., at **http://www/bxwa.com**; 2607 Wetmore Avenue, Everett, WA 98201-2929, (425) 258-1303, Fax (425) 259-3832. Click on: "bxwa.com"; "Posted Projects"; "Public Works", "PUD #1 of Skagit County" and "Projects Bidding". *(**Note**: Bidders are encouraged to "Register as a Bidder" in order to receive automatic e-mail notification of future addenda and to be placed on the "Bidders List". This service is provided **free of charge** to Prime Bidders, Subcontractors and Vendors bidding this project. Contact Builders Exchange of Washington at (425) 258-1303, should you require further assistance.)* Contract documents will be available on or after March 19, 2025.

Point of Contact: Catherine Price, Contract Coordinator

PUBLIC UTILITY DISTRICT NO. 1 OF SKAGIT COUNTY

GSidhu

George Sidhu, P.E., General Manager

Published: March 19, 2025, and March 26, 2025 (Skagit Valley Herald)
March 19, 2025, 2025 (Daily Journal of Commerce)

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INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

1. GENERAL

The **W1 Pump System Replacement Project** consists of the following:

> Installation of a new pump system at the Judy Reservoir Water Treatment Plant to replace the existing W1 pump system. The new pump system will include three pumps, motors, motor control centers, VFD control systems, flow meter, bladder pressure tanks, mechanical appurtenances and modifications, and electrical equipment. Portions of the existing W1 pump system will need to be maintained during the installation of the new pump system to achieve continuity of service throughout the project.

An unofficial bid set can be viewed on PUD's website www.SkagitPUD.org, or at Skagit PUD's office located at 1415 Freeway Drive, Mount Vernon, Washington 98273. Construction plans, specifications, addenda, and plan holders list for this project can be viewed or purchased on-line through Builders Exchange of Washington, Inc., at **http://www/bxwa.com**; 2607 Wetmore Avenue, Everett, WA 98201-2929, (425) 258-1303, Fax (425) 259-3832. Click on: "bxwa.com"; "Posted Projects"; "Public Works", "PUD #1 of Skagit County" and "Projects Bidding". *(**Note**: Bidders are encouraged to "Register as a Bidder" to receive automatic e-mail notification of future addenda and to be placed on the "Bidders List". This service is provided **free of charge** to Prime Bidders, Subcontractors and Vendors bidding on this project. Contact Builders Exchange of Washington at (425) 258-1303, should you require further assistance.)* Addenda will be sent out to those who "Register as a Bidder" on Builders Exchange of Washington, Inc., at **http://www/bxwa.com**. Contract documents will be available on or after March 19, 2025.

2. LOCATION

The location for the project is 12115 Morford Road, Sedro Woolley, within the County of Skagit, State of Washington as shown on the Contract Drawings. The project site is secured with a chainlink fence and locked gates.

3. EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE

Bidders shall satisfy themselves as to construction conditions by personal examination of the Plans, Specifications, other Bid Documents, and from attendance at applicable Pre-Bid Meetings. Bidders shall carefully correlate their observations with the requirements of the Contract Documents and shall otherwise satisfy themselves regarding the expense and difficulties associated with performing the Work and shall fully account for it in their bids. The submission of a bid shall constitute a representation of compliance by the Bidder with this requirement.

4. BID DOCUMENTS

The Bid Documents for the Project include the following:

1. Project Manual including general and technical specifications.

2. Contract Drawings. – ***Note: To be viewed or printed in color to distinguish between the existing and new infrastructure. New work is not shown in bold.***

5. BIDS

The project will be awarded based on the lowest responsive responsible Bidder.

Bids shall be made on the forms included herewith and shall be addressed to the Public Utility District No. 1 of Skagit County, 1415 Freeway Drive, Mount Vernon, Washington 98273. Each Bid shall be placed in a sealed envelope and shall be mailed or delivered to the Public Utility District No. 1 of Skagit County, to arrive no later than 10:00 AM on April 9, 2025. All complete Bids will be opened and publicly read aloud immediately following. No Bid may be withdrawn after the time set for the Bid opening or before award and execution of the contract unless the Owner does not award the contract within sixty (60) calendar days after the opening of Bids.

6. BID DEPOSIT

As a guarantee of good faith and as required by law, each Bid shall be accompanied by a Bid Deposit in the form of certified check, cashier's check, postal money order, or surety bond payable to the order of the "Public Utility District No. 1 of Skagit County" for an amount not less than 5 percent of the total amount of the Bid, including all potential additions and alternatives, but not including sales tax. If a surety bond is to be used as the bid deposit, the document included with the bid submission must have original signatures. The Bid Deposits of the three lowest Bidders will be retained until the Contract between the successful Bidder and the Owner have been entered into and a Performance and Payment Bond in an amount of one hundred percent (100%) of the contract price has been filed as required under these Contract Documents. The Bid Deposits of each other Bidder will be returned as soon as it is determined that they are not one of the three lowest Bidders.

7. EVALUATION OF BIDS AND AWARD OF CONTRACT

The Owner will award the Bid to the lowest responsive, responsible Bidder based on the Total Bid Amount only or Total Bid Amount plus the Alternate including sales tax as stated on the Bid Proposal Form. In the case of a conflict between the Total Bid Amount as stated numerically and as stated in words, the words shall take precedence.

In the case of a conflict between the quantity, unit price and unit price extension for a given bid item, the Owner will adjust the unit price extensions based on the unit price. If the Bidder does not provide a unit price or a unit price extension for every bid item, the bid will be considered non-responsive.

The right is reserved by the Owner to waive any and all informality in the Bids, to reject any or all Bids, including nonresponsive, unbalanced, or conditional bids, to reject any or all schedules, to re-advertise for new Bids, or to otherwise carry out the Work. The Owner reserves the right to reject any bid that is materially unbalanced to the Owner's potential detriment. The Owner further reserves the right to delete portions of the Work.

Bids which are incomplete, or which are conditioned in any way, or which contain erasures, alterations, or items not called for in the Bid Form, or which are not in conformity with the law or these Instructions, may be rejected as non-responsive.

8. RESPONSIBILITY CRITERIA

Before the Owner awards the contract, state law is used to determine that responsible contractors and subcontractors perform the work. Bidder responsibility is determined by the Bidder successfully demonstrating its ability to satisfy the mandatory responsibility criteria and any project specific criteria established by the Owner.

To comply with the responsibility criteria for this bid, a Bidder must provide sufficient information as required. If the Bidder fails to provide the requested information within the time and manner specified in these bid documents, the Owner reserves the option to determine responsibility upon any available information related to any supplemental criteria and/or may find the Bidder not responsible. If the lowest Bidder is found not responsible, the Owner reserves the right to award to the next lowest Bidder without re-advertising or rebidding the project.

9. MANDATORY RESPONSIBILITY CRITERIA

It is the intent of Owner to award a contract to the low responsible bidder. Before award, the bidder must meet the following Bidder responsibility criteria to be considered a responsible bidder. The Bidder may be required by the Owner to submit documentation demonstrating compliance with the criteria. The Bidder must:

1. Have a current certificate of registration as a contractor in compliance with chapter 18.27 RCW, which must have been in effect at the time of bid submittal.

2. Have a current Washington Unified Business Identifier (UBI) number.

3. If applicable, have Industrial Insurance (workers' compensation) coverage for the bidder's employees working in Washington, as required in Title 51 RCW.

4. Have a Washington Employment Security Department number, as required in Title 50 RCW.

5. Have a Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW.

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

7. Until December 31, 2013, not violated more than one time the off-site, prefabricated, non-standard, project specific items reporting requirements of RCW 39.04.370.

8. For public works projects subject to the apprenticeship utilization requirements of RCW 39.04.320, not have been found out of compliance by the Washington state apprenticeship and training council for working apprentices out of ratio, without appropriate supervision, or outside their approved work processes as outlined in their standards of apprenticeship under chapter 49.04 RCW for the one-year period immediately preceding the first date of advertising for the project.

9. Prior to the award date, the Contractor shall produce evidence of having received by the Department of Labor & Industries training on prevailing wage and public works requirements or are exempt under RCW 39.04.350.

10. SUBCONTRACTOR RESPONSIBILITY CRITERIA

Before award, the Bidder shall verify responsibility criteria for each first-tier subcontractor the Contractor hires and a subcontractor of any tier subcontractor that hires other subcontractors must verify responsibility criteria for each of its subcontractors. Verification shall occur at the time of subcontract execution and shall include that each subcontractor meets the responsibility criteria listed in Section 6.03 and possesses an electrical contractor license (if required by RCW Chapter 19.28) or an elevator contractor license (if required by RCW Chapter 70.87). These verification requirements, as well as the responsibility criteria,

shall be included in each of the Contractor's subcontracts of any tier. The Contractor shall certify that this verification is complete prior to contract close-out.

11. PROTESTS

Any Bidders wanting to file a bid protest shall submit a formal protest consisting of a written letter signed by an authorized official of the company within 48 hours of the bid opening. The protest will be reviewed by the Owner and if warranted, a meeting will be held with the Owner, the low Bidder and the Bidder filing the protest within four (4) calendar days to review the protest. A decision on the protest will be made by the Owner within seven (7) calendar days.

12. CONTRACT TIME

The Contract completion date is an essential part of the Contract, and it will be necessary for each Bidder to satisfy the Owner of its ability to complete the Work within the time allowed. Bidders shall base their bids on utilizing the full Contract Time of 365 consecutive calendar days for the Work, as specified.

13. FAILURE TO EXECUTE CONTRACT AND FURNISH BOND

In the event the successful Bidder fails to furnish a Payment and Performance Bond complying with this Invitation for Bids, and fails to sign the contract within ten (10) calendar days after notification by the Owner, an amount equal to 5 percent of the amount of the Bid shall be forfeited to the Owner as liquidated damages, and it is agreed that this said sum is a fair estimate of the amount of damages the Owner would sustain in the event that the Bidder failed to enter into the Contract or furnish the required Bond. Said liquidated damages shall be paid from the Bid Deposit submitted with the Bid. Other Bids will then be reconsidered for award by the Owner.

14. CORRECTIONS, INTERPRETATIONS, AND ADDENDA

If Bidders find or observe any omissions, discrepancies, or need for interpretations of the Bid Documents, they shall bring such facts in writing to the attention of the Owner. Written addenda to clarify questions which arise will then be issued. Interpretations or explanations of the Contract Documents will be in the form of written addenda only. Oral statements by the Owner, Engineer, or other representative of the Owner whether made before or after award of the Contract shall in no way modify the Contract Documents.

Any requests for information or interpretation of the Bid Documents shall be made by phone or email to Catherine Price, Contract Coordinator (360) 848-4472 or Price@SkagitPUD.org. All such requests shall be received no later than three (3) working days prior to bid opening.

15. SUBCONTRACTORS & SUPPLIERS

In compliance with RCW 39.30.060 for all projects estimated to cost $1 million or more, all Bidders must complete and submit the Subcontractors List form provided in the Bid Proposal Forms. The Subcontractors List form must be submitted with the Bid. The failure of a Bidder to submit the names of such subcontractors, or to name itself to perform such work, or the naming of two or more firms (subcontractors or Bidders) to perform the same work shall render the Bidder's bid non-responsive and, therefore, void.

16. BIDDER QUALIFICATIONS

All Bidders shall submit with their bids evidence of sufficient qualifications and experience for the work as specified in Bid Proposal Forms. The Owner will utilize the information submitted for the purpose of determining the responsibility of the low Bidder for determining eligibility for award.

17. PERMITS

For this project, the only required permit is the Electrical Permit which will be procured and paid for by the Contractor.

18. PRE-BID MEETING

A Pre-Bid Meeting will be held at 1:30 PM on April 1, 2025, at the Project site located at 12115 Morford Road, Sedro-Woolley, Washington.

END OF SECTION

MANDATORY BIDDER RESPONSIBILITY CHECKLIST

The following checklist may be used by Owners in documenting that a Bidder meets the mandatory bidder responsibility criteria. It is suggested that Owners print a copy of documentation from the appropriate website to include with this checklist in the contract file.

General Information	
Project Name:	Project Number:
Bidder's Business Name:	Bid Submittal Deadline:
Contractor Registration – https://fortress.wa.gov/lni/bbip/	
License Number:	Status: Active: Yes ☐ No ☐
Effective Date (must be effective on or before Bid Submittal Deadline):	Expiration Date:
Is Bidder on Infraction List?	Yes ☐ No ☐
Current UBI Number – http://dor.wa.gov/content/doingbusiness/registermybusiness/brd/	
UBI Number:	Account Closed: Open ☐ Closed ☐
Industrial Insurance Coverage – https://fortress.wa.gov/lni/crpsi/MainMenu.aspx	
Account Number:	Account Current: Yes ☐ No ☐
Employment Security Department Number –	
Employment Security Department Number:	
• Has Bidder provided account number on the Bid Form? Yes ☐ No ☐ • And/or have you asked the Bidder for documentation from Employment Security Department on account number? Yes ☐ No ☐	
State Excise Tax Registration Number – http://dor.wa.gov/content/doingbusiness/registermybusiness/brd/	
Tax Registration Number:	Account Closed: Open ☐ Closed ☐
Not Disqualified from Bidding – http://www.lni.wa.gov/TradesLicensing/PrevWage/AwardingAgencies/DebarredContractors/default.asp	
Is the Bidder listed on the "Contractors Not Allowed to Bid" list of the Department of Labor and Industries? Yes ☐ No ☐	
Checked by:	
Name of Employee:	Date:

SUBCONTRACTOR RESPONSIBILITY CHECKLIST

The following checklist may be used by Contractors and Subcontractors in documenting that a subcontractor of any tier meets the subcontractor responsibility criteria. It is suggested that Contractors and Subcontractors print a copy of documentation from the appropriate website to include with this checklist in their contract file.

General Information	
Project Name:	Project Number:
Subcontractor's Business Name:	Subcontract Execution Date:
Contractor Registration – https://fortress.wa.gov/lni/bbip/	
License Number:	Status: Active: Yes ☐ No ☐
Effective Date (must be effective on or before Subcontract Bid Submittal Deadline):	Expiration Date:
Current UBI Number – http://dor.wa.gov/content/doingbusiness/registermybusiness/brd/	
UBI Number:	Account Closed: Open ☐ Closed ☐
Industrial Insurance Coverage – https://fortress.wa.gov/lni/crpsi/MainMenu.aspx	
Account Number:	Account Current: Yes ☐ No ☐
Employment Security Department Number –	
Employment Security Department Number:	
• Has Subcontractor provided account number on the Bid Form? Yes ☐ No ☐ • And/or have you asked the Subcontractor for documentation from Employment Security Department on account number? Yes ☐ No ☐	
State Excise Tax Registration Number – http://dor.wa.gov/content/doingbusiness/registermybusiness/brd/	
Tax Registration Number:	Account Closed: Open ☐ Closed ☐
Not Disqualified from Bidding – http://www.lni.wa.gov/TradesLicensing/PrevWage/AwardingAgencies/DebarredContractors/default.asp	
Is the Subcontractor listed on the "Contractors Not Allowed to Bid" list of the Department of Labor and Industries? Yes ☐ No ☐	
Contractor Licenses – https://fortress.wa.gov/lni/bbip/	
Electrical: If required by Chapter 19.28 RCW, does the Subcontractor have an Electrical Contractor's License? Yes ☐ No ☐	Elevator: If required by Chapter 70.87 RCW, does the Subcontractor have an Elevator Contractor's License? Yes ☐ No ☐
Checked by:	
Name of Employee:	Date:

CERTIFICATION OF COMPLIANCE WITH WAGE PAYMENT STATUTES

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date of March 19, 2025, the bidder is not a "willful" violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

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

_____
Bidder

_____
Signature of Authorized Official*

_____
Printed Name

_____
Title

_____ _____ _____
Date City State

Check One:
Individual ☐ Partnership ☐ Joint Venture ☐ Corporation ☐

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

_____

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

_____

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

SECTION 00 40 00

PROCUREMENT FORMS AND SUPPLEMENTS

BIDDER'S CHECKLIST

This Checklist has been prepared and furnished to aid Bidders in including all necessary supporting information with their Bid. Bidder's submittals shall include, but not be limited to, the following:

No.	Bid Proposal Item	Checked
1.	Bid to Commission	☐
2.	Bid Schedule	☐
3.	Proposal Signature, Addenda Acknowledgment and Non-Collusion Declaration Sheet	☐
4.	Subcontractors List	☐
5.	Bidder’s Qualifications	☐
6.	Bid Deposit	☐

BID TO COMMISSION

TO: Board of Commissioners
Public Utility District No. 1 of Skagit County, Washington

Gentlemen:

The undersigned has examined the site, specifications, plans, laws, and ordinances covering the improvements contemplated. In accordance with the terms, provisions and requirements of the foregoing, the following lump sums and unit prices are tendered as an offer to perform the Work and furnish the labor, tools, equipment, materials, appurtenances, incidentals, and guarantees, where required, complete in place, in good working order.

As a guarantee of good faith and as required by law, a Bid Deposit in the form of a certified check, cashier's check, postal money order or surety bond made payable to the order of Public Utility District No. 1 of Skagit County ("District") is attached hereto. The undersigned understands and hereby agrees that, should this offer be accepted and the undersigned fail or refuse to enter into a Contract, furnish the required Payment and Performance Bond and required liability insurance, the undersigned shall forfeit to the District an amount equal to five percent (5%) of the amount Bid as liquidated damages, all as provided for in this Invitation for Bids.

The undersigned hereby proposes to undertake and complete the work embraced in this improvement, in accordance with the terms of the Specifications and Contract Documents, at the following lump sum and unit prices:

W1 PUMP SYSTEM REPLACEMENT PROJECT

BID SCHEDULE

No.	Bid Schedule Description	Estimated Quantity	Unit Price	Total
1.	Mobilization, Demobilization, Site Preparation, and Cleanup	1 LS	$	$
2.	Contractor Health and Safety Plan, Site-Specific Safety Plan, and Spill Prevention Control and Countermeasure (SPCC) Plan	1 LS	$	$
3.	Pump Station Mechanical	1 LS	$	$
4.	Magnetic Flow Meter Installation	1 LS		
5.	Pumps and Motors	1 LS	$	$
6.	Pressure Tanks and Mechanical	1 LS	$	$
7.	Pump Station Electrical	1 LS	$	$
8.	Control System by QCC	1 LS	$ 208.230.00	$ 208,230.00
9.	Control System Coordination	1 LS	$	$
10.	Testing, Startup, and Training	1 LS	$	$
11.	Operation and Maintenance Manuals	1 LS	$	$
12.	Construction Records	1 LS	$	$

Sub-Total Base Bid $ _____

Sales Tax (8.6%) $ _____

Total Bid Amount including Sales Tax $ _____

_____ **DOLLARS**

Total Bid Amount (written in words)

ADDITIVE ALTERNATE				
No.	**Bid Schedule Description**	**Estimated Quantity**	**Unit Price**	**Total**
14.	Remove and Dispose of Existing Raw Water Pumps and Motors	1 LS	$	$

Sub-Total Base Bid Including Additive Alternate $ _____

Sales Tax (8.6%) $ _____

Total Bid Amount Including Additive Alternate & Sales Tax $ _____

_____ **DOLLARS**

Total Bid Amount (written in words)

PROPOSAL SIGNATURE, ADDENDUM ACKNOWLEDGMENT AND NON-COLLUSION DECLARATION

The bidder is hereby advised that by signature of this proposal he/she is deemed to have acknowledged all requirements and signed all certificates contained herein. The undersigned hereby agrees to pay to labor not less than the prevailing rates of wages or less than the hourly minimum rate of wages as specified in the Specifications and Conditions for this project. A proposal guarantee in an amount of five percent (5%) of the total bid not including sales tax, based upon the approximate estimate of quantities at the above prices and in the form as indicated below, is attached hereto:

CASH $ _____ CASHIER'S CHECK $ _____

BID BOND $ _____ CERTIFIED CHECK $ _____

Receipt is hereby acknowledged of Addenda Nos. _____, _____, and _____.

I, by signing the proposal, hereby declare, under penalty of perjury under the laws of the United States that the undersigned person(s), firm, association or corporation has (have) not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the project for which this proposal is submitted.

SIGNATURE OF AUTHORIZED OFFICIAL(S)
NOTE: Proposal must be signed

Signature _____

Firm Name _____

Address _____

_____

_____
Washington State Contractor's License Number

Sworn to before me this _____ day of _____, 20_

_____
(SEAL) NOTARY PUBLIC

SUBCONTRACTORS LIST – RCW 39.30.060 FORM

In compliance with RCW 39.30.060 for all projects estimated to cost $1 million or more, all Bidders must complete and submit this Subcontractors List form with their Bid Proposal.

List of Subcontractors: The Bidder shall indicate on the Subcontractors List the names of the subcontractors with whom the Bidder, if awarded the contract, will subcontract for performance of the work of heating, ventilation and air conditioning, plumbing as described in Chapter 18.106 RCW, and electrical as described in Chapter 19.28 RCW.

List Bidder if Bidder Performing Work: If the Bidder will perform the work in any of the three areas required, the Bidder shall name itself for the work on the Subcontractors List.

Name Only One Form for Each Category of Work: The Bidder shall not list more than one firm (subcontractor or Bidder) for each category of work identified, unless subcontractors vary with bid alternates or additive, in which case the Bidder must indicate which firm will be used for which alternate or additive.

Substitution of Subcontractors: Substitution of any listed subcontractor may only be according to the procedure and parameters set forth in RCW 39.30.060.

Factors relating to Non-Responsiveness: Failure of the Bidder to submit the names of such subcontractors, or to name itself to perform such work, or the naming of two or more firms (subcontractor or Bidder) to perform the same work shall render the Bidder's bid non-responsive and, therefore, void.

Applicable to Direct Subcontractors: The requirement of this section to name the Bidders' proposed heating, ventilation and air conditioning, plumbing and electrical subcontractors applies only to proposed heating, ventilation and air conditioning, plumbing and electrical subcontractors who will contract directly with the Bidder.

Submission Requirements: The Subcontractors List must be submitted with the Bid Proposal.

Trade	**Bidder must check one box for each Trade. If subcontracting the work, Bidder must name the subcontractor.**
HVAC (Heating, Ventilation and Air Conditioning	□ N/A (this project does not include this work) □ Bidder will self-perform this work □ Name and address of subcontractor _____ _____
Plumbing	□ N/A (this project does not include this work) □ Bidder will self-perform this work □ Name and address of subcontractor _____ _____
Electrical	□ N/A (this project does not include this work) □ Bidder will self-perform this work □ Name and address of subcontractor _____ _____

Structural Steel Installation	□ N/A (this project does not include this work) □ Bidder will self-perform this work □ Name and address of subcontractor _____ _____ □
Rebar Installation	□ N/A (this project does not include this work) □ Bidder will self-perform this work □ Name and address of subcontractor _____ _____ □
Other Subcontractor	□ N/A (this project does not include other subcontractor work) □ Name and address of subcontractor _____ _____ □

BIDDER'S QUALIFICATIONS

1. Comparable Contract History

The following is a partial list of the jobs our organization completed within the past five (5) years which are similar in character to this project.

Year	Project Name	Owner Representative	Owner's Phone No.

2. Superintendent Work History

The following is a partial list of the jobs our superintendent, _____

completed within the past five (5) years which are similar in character to this project.

Year	Project Name	Owner Representative	Owner's Phone No.

3. Project Manager Work History

The following is a partial list of the jobs our project manager, _____

completed within the past five (5) years which are similar in character to this project.

Year	Project Name	Owner Representative	Owner's Phone No.

Name of Company: _____

Address: _____

_____

Telephone: _____

Date _____

Signature _____

Title _____

Contractor's License Number _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, _____

_____

of _____

Hereinafter called the Contractor (Principal), and _____

_____

a corporation duly organized and existing under and by virtue of the laws of the State of _____ hereinafter called the Surety, and authorized to transact business within the State of Washington as Surety, are held and firmly bound unto Public Utility District No. 1 of Skagit County, Washington (Obligee) in the full and penal sum of five percent (5%) of the total bid amount appearing on the bid proposal of said principal for the work hereinafter described, for the payment of which, well and truly be made to the Owner, the Contractor and the Surety bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THE ABOVE OBLIGATION ARE SUCH THAT WHEREAS, the Principal herein is herewith submitting his or its bid proposal for the **JUDY WTP W1 PUMP SYSTEM REPLACEMENT PROJECT.**

NOW THEREFORE, if the bid proposal submitted by the Principal is accepted, and the contract is awarded to said Principal, and if said Principal shall duly make and enter into and execute said contract and shall furnish the Performance and Payment Bond as required by the bidding and contract documents within a period of ten (10) days from and after said award, exclusive of the day of such award, then its obligation to pay the above-mentioned penal sum as liquidated damages shall be null and void, otherwise it shall remain and be in full force and effect.

Signed and sealed this _____ day of _____, 20____.

_____	_____
Contractor	Surety
By _____	By _____
	Attorney-In-Fact
Title _____	
Corporate Seal	Corporate Seal

The Attorney-In-Fact who executes this bond on behalf of the Surety must attach a copy of his Power of Attorney as evidence of his authority.

SECTION 00 52 00

AGREEMENT FORMS

CONTRACT NO. XXXX

THIS CONTRACT is made and entered into by and between the PUBLIC UTILITY DISTRICT NO. 1 OF SKAGIT COUNTY (Owner/Skagit PUD) and CONTRACTOR NAME (Contractor).

WITNESSETH:

WHEREAS, the Owner has caused the preparation of certain Contract Documents entitled **W1 Pump System Replacement Project.**

WHEREAS, the Owner has invited proposals, has received and analyzed said proposals, and has duly given notice of Acceptance of Proposal to the Contractor herein set forth and as stated more in detail in the Contract Documents which are defined in Section II General Conditions, all of which Contract Documents are made a part hereof and which constitute the whole Contract between the Owner and the Contractor.

NOW, THEREFORE, it is hereby agreed that:

1. The Contractor shall furnish the work, pay all costs, and perform all requirements of this Contract in the manner specified in the Contract Documents, and;

2. The Proposal calls for unit prices and lump sums in the Bid Schedule(s) set forth in (1) above. The Owner shall pay to the Contractor a corrected Total Contract Amount computed from the unit prices and lump sums in said Bid Schedule(s) set forth in the Contractor's Proposal and the actual quantities of units furnished. Based upon the lump sum and unit prices in said Bid Schedule(s) set forth in the Contractor's Proposal and upon the quantities estimated from the Contract Drawings for bidding purposes, the estimated Total Contract Amount is (spell out dollar amount/100) Dollars (capitalize each word of the dollar amount) ($ insert numeric dollar amount); and

3. In Washington State the Owner is required to pay state or local sales or use taxes included in the Total Contract Amount and the Contractor is required to receive the said taxes for payment to the state, the amount payable to the Contractor by the Owner shall be the Total Contract Amount as above specified including the amount of the said taxes, and;

4. It is further agreed that the Contractor will start work within ten (10) calendar days after the date specified in the Owner's Notice to Proceed and shall be substantially complete within 365 consecutive calendar days from the date of Notice to Proceed is issued, and;

5. In the event that the Contractor fails to substantially complete the Project by the date of substantial completion as specified above or as modified by Change Order, the Contractor shall be liable for liquidated damages of (spell out dollar amount/100) Dollars ($ insert numeric dollar amount) per calendar days thereafter until the Owner determines the Project to be substantially complete, and;

6. The attached Indemnification Agreement is hereby made part of this Contract.

IN WITNESS WHEREOF, two identical counterparts of this Contract, each of which shall for all purposes be deemed an original hereof, have been duly executed by the parties hereto.

(CONTRACTOR name here)	PUBLIC UTILITY DISTRICT NO. 1 OF SKAGIT COUNTY, WASHINGTON
By _____ (Name, Title here)	By _____ George Sidhu, P.E., General Manager
Date _____	Date _____

INDEMNIFICATION AGREEMENT

The Contractor agrees to defend, indemnify, and hold Skagit PUD harmless from any and all claims, demands, losses, and liabilities to or by third parties arising from, resulting from, or connected with work performed or to be performed under this Contract by the Contractor, its agents, employees, and subcontractors, even though such claims may prove to be false, groundless or fraudulent, to the fullest extent permitted by law and subject to the limitations provided below.

The Contractor's duty to indemnify Skagit PUD shall not apply to liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence of Skagit PUD or Skagit PUD's agents or employees. The Contractor's duty to indemnify Skagit PUD for liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the concurrent negligence of Contractor, its agents, employees, or subcontractors and/or Skagit PUD or Skagit PUD's agents or employees, shall apply only to the extent of negligence of Contractor, its agents, employees, or subcontractors.

With respect to claims against Contractor by Skagit PUD pursuant to this Contract only, Contractor expressly waives any immunity that may be granted it under the Workers' Compensation, Industrial Insurance or like statutes and/or any administrative regulations issued pursuant thereto. This waiver does not include or extend to any claims by Contractor's employees directly against Contractor.

Further, Contractor's defense and indemnification obligations under this Contract shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable to or for any third party under Workers' Compensation, Industrial Insurance or like statutes and/or any administrative regulations issued pursuant thereto.

Contractor's duty to indemnify Skagit PUD for liabilities or losses, other than for bodily injury to persons or damage to property caused by or resulting from negligence, shall apply only to the extent of the fault of Contractor, its agents, employees, or subcontractors, except in situations where fault is not a requirement for liability, in which case indemnity will be provided to the extent the liability or loss was caused by Contractor or its agents, employees, or subcontractors.

Contractor's duty to defend, indemnify and hold Skagit PUD harmless shall include, as to all claims, demands, losses and liabilities to which it applies, Skagit PUD's actual attorneys' fees and costs incurred in connection with defending such claim(s) including, without limitation, consultant and expert witness fees and expenses and personnel-related costs in addition to costs otherwise recoverable by statute or court rule.

THE UNDERSIGNED HEREBY CERTIFY THAT THIS AGREEMENT WAS MUTUALLY NEGOTIATED.

(CONTRACTOR name here)	PUBLIC UTILITY DISTRICT NO. 1 OF SKAGIT COUNTY, WASHINGTON
By: _____ **(Name, Title here)**	By: _____ George Sidhu, P.E., General Manager
Dated: _____	Dated: _____

The Contractor shall cause each of its subcontractors (and suppliers to the extent any perform any work on the Project site) to execute an Indemnification Contract substantially in the form of the foregoing by which each such entity or person assumes to Skagit PUD all obligations Contractor assumes to Skagit PUD as set forth above.

CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned, **Peter Gilbert**, the duly authorized and acting legal representative of Public Utility District No. 1 of Skagit County, do hereby certify as follows:

I have examined the attached contract(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements are adequate and have been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions, and provisions thereof.

_____

Peter Gilbert, Attorney

Date: _____

PERFORMANCE AND PAYMENT BOND

Bond No._____
Amount: $_____

KNOW ALL MEN BY THESE PRESENTS, that

_____

Of_____
Hereinafter called the Contractor (Principal), and _____

_____

a corporation duly organized and existing under and by virtue of the laws of the State of _____ hereinafter called the Surety, and authorized to transact business within the State of Washington as Surety, are held and firmly bound unto Public Utility District No. 1 of Skagit County, Washington as Owner (Obligee), in the sum of _____ Dollars ($_____), lawful money of the United States of America, for the payment of which, well and truly be made to the Owner, the Contractor and the Surety bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

THE CONDITIONS OF THE ABOVE OBLIGATION ARE SUCH THAT:
WHEREAS, the Contractor has executed and entered into a certain Contract hereto attached, with the Owner, dated _____, 20____.
For:_____

_____.

IN WITNESS:NOW THEREFORE, if Contractor, its heirs, executors, administrators, successors, or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the said Contract for the duration thereof, including the one-year warranty period, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, at the time and in the manner therein specified and shall pay all laborers, mechanics, subcontractors or lower tier subcontractors, and material persons, and all persons who shall supply such person or persons, or subcontractors or lower tier subcontractors, with provisions and supplies for the carrying on of such work, on his or their part, and shall indemnify and save harmless Owner, its officers and agents, then this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

And Surety, for value received, hereby further stipulates and agrees that no change, extension of time, alteration or addition to the terms of Contract or to the work to be performed thereunder or the plans or specifications accompanying the same shall in any way affect its obligation of this Bond, and it does hereby waive notice of any change, extension of time, alterations or additions to the terms of the Contract, the plans or the specifications.

Surety hereby agrees that modifications and changes may be made in the terms and provisions of the Contract without notice to Surety, and any such modifications or changes increasing the total amount to be paid the Contractor shall automatically increase the obligation of the Surety on this Bond in a like amount.

The Surety expressly acknowledges that it shall be liable, under this Bond, for any liquidated damages assessed against the Contractor in accordance with the provisions of the Contract.

Any claim(s) relating to or against this Bond shall be subject to and decided by arbitration in accordance with the provisions of the Revised Code of Washington Chapter 7.04.

Any dispute relating to the performance or enforcement of the provisions of this Bond shall be governed by Washington State Law. Jurisdiction and venue shall be Skagit County Courts. If non-binding arbitration or mediation is conducted involving the Owner, the Contractor, the Surety, or any other party concerning or in any way relating the work required or alleged to be required by the Contract, the Contractor and Surety expressly consent to a consolidated or joint arbitration if and as called for by the Owner. The prevailing party in each such litigation shall be entitled to recover its attorneys' fees, in addition to any other relief granted.

IN WITNESS WHEREOF, the Contractor and the Surety have caused this bond and two (2) counterparts thereof to be signed and sealed by their duly authorized officers.

Signed and sealed this _____ day of _____, 20____.

_____	_____
Contractor	Surety
By _____	By _____
	Attorney-In-Fact
Title _____	
Corporate Seal	Corporate Seal

Address of local office and agent of Surety Company:

_____
_____
_____
_____

APPROVED AS TO FORM:

PUD attorney: _____, Owner _____, 20____

SECTION 00 72 00

GENERAL CONDITIONS

GENERAL CONDITIONS

NOTICE OF DISCLAIMER

TAKE NOTICE, that the General Conditions are the 2025 Edition of the Washington State Department of Transportation Standard Specifications for Road, Bridge and Municipal Construction.

TAKE NOTICE, that these General Conditions have been materially amended by certain additions, deletions or other modifications to meet the needs of the Public Utility District No.1 of Skagit County. These amendments are contained in the Supplementary General Conditions.

END OF SECTION

SECTION 00 73 00

SUPPLEMENTARY CONDITIONS

SUPPLEMENTARY GENERAL CONDITIONS

The following provisions of the Washington State 2025 Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT) Division 1 General Requirements is hereby amended, changed, or supplemented and superseded as follows. All other provisions which are not amended, changed, or supplemented remain in full force.

1	Order of Precedence	
2	Section 1-01.3	Definitions
3	Section 1-03	Award and Execution of Contract
3.1	Section 1-03.4	Contract Bond
3.2	Section 1-03.8	Award and Execution of Contract
4	Section 1-05	Control of Work
4.1	Section 1.05.0	General
4.2	Section 1-05.4	Conformance with and Deviations from Plans and Stakes
4.3	Section 1-05.10	Guarantees
5	Section 1-07	Legal Relations and Responsibilities to the Public
5.1	Section 1-07.1(1)	Owner Safe Access
5.2	Section 1-07.6	Permits and Licenses
5.3	Section 1-07.9	Wages
5.4	Section 1-07.18(1)	Public Liability and Property Damage Insurance
5.5	Section 1-07.26	Personal Liability of Public Officers
6	Section 1-08	Prosecution and Progress
6.1	Section 1-08.5	Time for Completion (Contract Time)
6.2	Section 1.08.9	Liquidated Damages
6.3	Section 1.08.10(2)	Termination for Public Convenience
7	Section 1-09	Measurement and Payment
7.1	Section 1-09.4	Equitable Adjustment
7.2	Section 1-09.6	Force Account
7.3	Section 1-09.11(3)	Time Limitations and Jurisdiction
7.4	Section 1-09.13(3)	Claims Resolution
7.5	Section 1-09.14	Claims Against Contractor’s Retainage and/or Public Contract Bond

1 ORDER OF PRECEDENCE. THE ORDER OF PRECEDENCE OF THE CONDITIONS OF THE CONTRACT ARE AS LISTED BELOW, FIRST IS THE HIGHEST AND LAST IS THE LOWEST:

Addenda
Bid Forms
Technical Specifications
Drawings
Special Provisions
Supplementary General Conditions
Division 1 General Requirements (WSDOT) 2025 Edition

2 SECTION 1-01.3 DEFINITIONS IS SUPPLEMENTED BY ADDING THE FOLLOWING DEFINITIONS:

Whenever these words are used in the Contract Documents, they shall have the following meanings:

"COMMISSION": Redefined to mean the three elected Commissioners of Skagit PUD; substitute for "Commission" and "Washington State Transportation Commission" whenever cited.

"CONTRACTING AGENCY", "DISTRICT" or "OWNER": Public Utility District No. 1 of Skagit, Washington; substitute for "State," "Department," and "Department of Transportation" whenever cited.

"GENERAL MANAGER": The person appointed by the Commission per RCW 54.16.100 as the chief administrative officer of Skagit PUD; substitute for "Secretary" and "Secretary of Transportation" whenever cited.

"ENGINEER": Public Utility District No. 1 of Skagit County and its sub consultants.

"STANDARD PLANS": Redefined to refer to the Standard Detail Sheets included with the Plans and Specifications as well as the WSDOT Standard Plans. The requirements of the Standard Detail Sheets shall be controlling in the case of any discrepancy between the Standard Details and the WSDOT Standard Plans.

3 SECTION 1-03 AWARD AND EXECUTION OF CONTRACT IS SUPPLEMENTED BY ADDING THE FOLLOWING:

3.1 Add the following to Section 1-03.4, Contract Bond:

Upon substantial completion of the Project, the Contractor shall provide a Utility Maintenance Bond for 25% of the Total Contract Amount on the form specified by Skagit PUD that warrants all equipment, materials, and labor it furnishes or performs under the Agreement against defects in design, materials, and workmanship for one (1) year after final acceptance as described in Section 1-05.10.

3.2 Add the following new Section 1-03.8 Award and Execution of Contract:

1-03.8 Award and Execution of Contract.

1-03.8(1) The Contract for the Project shall be awarded to the responsible Bidder submitting the lowest responsive Bid. The lowest responsive Bid shall be determined by the total of the amount of the base Bid and the amount(s) Bid for any alternate(s) which the Owner, in its discretion, elects to include in the Contract.

4 SECTION 1-05 CONTROL OF WORK IS REVISED AS FOLLOWS:

4.1 Insert the following new Section 1-05.0 General:

1-05.0 General

Where the Specifications, the Owner's instructions, laws, ordinances, or any government authority require any work to be specially tested, or inspected, the Contractor shall give the Owner timely notice that such test of completed work is ready for inspection. If the inspection is by another authority than the Owner, the Contractor shall give the Owner timely notice of the date fixed for such inspection. Required certificates of inspection by other authority than the Owner shall be secured by the Contractor.

4.2 Revise Section 1-05.4, Conformance with And Deviation from Plans and Stakes, as follows:

Delete the word “Engineer” and replace with “Contractor” throughout this section with reference to setting stakes, marks, lines, etc. for the layout and prosecution of the Work. All surveying and layout required for this Project shall be performed by the Contractor. The Engineer retains final authority for determination of conformity of the Work and shall be notified immediately of any errors found to cause deviations in the Work.

4.3 Delete Section 1-05.10, Guarantees, and replace with the following:

1-05.10 Guarantees

The Contractor shall furnish to the Contracting Agency any guarantee or warranty furnished as a normal trade practice in connection with the purchase of any equipment, materials, or items used in the construction of the project.

The Contractor shall be responsible for correcting all defects in workmanship and materials incurred within one year (365 days) after the date of final acceptance of the project. When corrections of defects are made, the Contractor shall be responsible for correcting all defects in workmanship and/or materials in the corrected Work for one year after acceptance of the correction by the Owner. The Contractor shall commence remedying such defects within seven (7) days of receipt of notice of discovery thereof from the Owner and shall complete such Work within a reasonable time. In emergencies, where damage may result from delay or where loss of service may result, such corrections may be made by the Owner, in which case the cost shall be borne by the Contractor. In the event the Contractor does not complete corrections within a reasonable time, the Work shall be otherwise accomplished and the cost of same shall be paid by the Contractor.

The Contractor shall be liable for any costs, losses, expenses, or damages, including consequential damages, suffered by the Owner resulting from defects in the Contractor's Work including but not

limited to costs, labor, materials, equipment, and administration incurred by Owner in making emergency repairs of such defective Work and associated costs of engineering, inspection, and supervision by the Owner or Engineer. The Contractor shall defend, indemnify and hold the Owner harmless from any and all claims which may be made against the Owner as a result of the Contractor's defective Work.

5 SECTION 1-07 LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC IS SUPPLEMENTED BY ADDING THE FOLLOWING:

5.1 Add the following Section 1-07.1(1) Owner Safe Access:

1-07.1(1) Owner **Safe Access.**

The Contractor shall provide safe access for the Owner and its inspectors to adequately inspect the quality of work and the conformance with Contract Documents. The Contractor shall provide adequate lighting, ventilation, ladders, and other protective facilities as may be necessary for the safe performance of inspections.

5.2 Add the following to Section 1-07.6, Permits and Licenses:

The Contractor shall comply with all requirements of all permits ~~provided by the Owner~~ for this project.

5.3 Add the following to Section 1-07.9, Wages, 1-07.9(1), General:

Current Washington State Department of Labor and Industries prevailing wage rates are available at:

https://secure.lni.wa.gov/wagelookup/rates/

Wage rates applicable for this project are those for Skagit County with an effective date of this Contract Bid Date.

5.4 Revise Section 1-07.18, Public Liability and Property Damage Insurance as follows:

All reference to the State or Department of Transportation shall be supplanted with Public Utility District No. 1 of Skagit County.

5.5 Revise Section 1-07.26, Personal Liability of Public Officers, as follows:

Neither the Owner nor any elected official, officer, or its employees shall be personally liable for any acts or failure to act in connection with the Contract, it being understood that in such manners, they are acting solely as agents of the Owner.

No right of action shall accrue upon or by reason of this Contract to or for the use or benefit of anyone other than the parties to this Contract. The parties to this Contract are the Contractor and the Owner.

6 SECTION 1-08, PROSECUTION AND PROGRESS, IS REVISED AS FOLLOWS:

6.1 Supplement Section 1-08.5, Time for Completion (Contract Time), with the following:

Contractor shall complete all work associated with the Bid Schedule within 365 consecutive calendar days after the issuance of the Notice to Proceed.

6.2 Section 1-08.9, Liquidated Damages replaced numbered paragraphs 1 and 2 with the following:

1. To pay liquidated damages for each working day beyond the number of days established for substantial completion, to authorize the Owner to deduct these liquidated damages from any money due or coming due to the Contractor.

6.3 Revise Section 1-08.10(2), Termination for Public Convenience, as follows:

Substitute "Resolution" for "Executive Order", substitute "Commission" for "President", and delete "or Governor".

7 SECTION 1-09, MEASUREMENT AND PAYMENT, IS REVISED AS FOLLOWS:

7.1 Supplement Section 1-09.4, Equitable Adjustment, with the following:

All bilateral agreements shall constitute a full accord and satisfaction and represent payment in full as to adjustments in both Contract price and time of completion for all costs, whether direct or indirect, arising out of, or incidental to, or otherwise attributable to, the changed work including any and all delays and impacts resulting from the change to the contract. Acceptance of payment by Contractor pursuant to such bilateral agreement shall constitute a waiver of any and all claims, known or unknown, arising out of, or incidental to, or otherwise attributable to the changed work.

7.2 Revise Section 1-09.6, Force Account, as follows:

Revise Item No. 1 as follows: Substitute “21 Percent” for “29 percent” for Contractor’s allowance for overhead and profit.

7.3 Revise Section 1-09.11(3), TIME LIMITATIONS AND JURISDICTION

Revise as follows: Substitute Public Utility District No.1 of Skagit County for State of Washington (six times). Substitute Superior Court of Skagit County for Superior Court of Thurston County.

7.4 Replace Sections 1-09.13(3), (3)A, (3)B and (4), Claims Resolution, with the following:

CLAIMS 1-09.13(3)

The Contractor and Contracting agency mutually agree that claims submitted in accordance with Section1-09.11 and not resolved by nonbinding ADR process, shall be resolved by litigation unless the Contracting agency elects to resolve the claim through binding arbitration.

Venue. The venue of any Dispute Resolution Proceedings between the parties to this Agreement shall be Mount Vernon, Washington unless otherwise mutually agreed in writing.

Injunctive Proceedings. Notwithstanding any other provisions of these Dispute Resolution Procedures, any Disputes otherwise subject to submission to these Dispute Resolution Procedures may instead be first submitted, by any party having a legal interest therein, to the jurisdiction of the Superior Court for Skagit County, State of Washington, if and only to the extent necessary to secure injunctive relief reasonably necessary under the circumstances.

7.5 Add the following new Section 1-09.14 Claims Against Contractor's Retainage and/or Public Contract Bond:

1-09.14 Claims Against Contractor's Retainage and/or Public Contract Bond

The Contractor shall be liable for all costs incurred by the Owner, including, but not limited to, legal fees, salary/wage costs of Owner's employees and litigation costs (whether or not recoverable by statute or court rule) arising out of claims against the retainage or the Contractor's Public Contract Bond. Owner may deduct any such costs from funds otherwise due the Contractor, including the retention, by unilateral Change Order.

END OF SECTION

SPECIFICATIONS GROUP

JUDY WATER TREATMENT PLANT
W1 PUMP SYSTEM REPLACEMENT PROJECT

These specifications and design drawings for the **Judy Water Treatment Plant W1 Pump System Replacement Project** have been prepared under the direction of the following Registered Professional Engineers.

Signed: 03/12/2025

Dan Burwell, PE
Project Manager
Divisions 1-15 and 18

Signed: 03/12/2025

Mark Braaksma, PE
Electrical Engineer
Divisions 16-17

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1.10 GENERAL

Sections in these specifications titled "*Common Work for . . .*" shall apply to all following subsections whether directly referenced or not.

Sections in these specifications titled "*Related Sections*" shall be read as integral to the specification as if they were fully detailed within. All work and materials described in such sections shall be provided and performed by the Contractor.

1.10.16 Definitions

[CSI 01 42 16]

Approximate: Generally as shown or described, but has not been verified, or may require adjustment. No level of accuracy is implied or should be assumed.

Or Equal (Or Approved Equal): An alternate product, assembly, or method that the Owner's Representative has reviewed based on information provided by the Contractor and determined to provide functional equivalence, or better, than that specified. Such determination does not relieve the Contractor from responsibility should the product, assembly, or method fail to perform as needed.

Owner's Representative: Person(s) authorized by the Owner to observe the work, administer the contract, approve tests, make decisions, and otherwise act as an agent of the Owner. The terms Engineer, Owner's Observer, Owner's Inspector, and Owner are generally interchangeable with the term Owner's Representative.

Proposed: The word refers to work that is part of the Contract, to be performed by the Contractor. The word "proposed" does not need to show up to indicate work by the Contractor. Unless work is specifically noted to be performed by others, all work is to be performed by the Contractor.

1.11.00 Summary of Work

[CSI 01 11 00]

The W1 Pump System Replacement Project consists of the construction of a pumping system to replace an existing pumping system (W1-1, W1-2 and SW Pumps). The project has no Federal Funding Requirements.

1.11.02 Reuse of Documents

[CSI 01 11 30]

Contractor and any Subcontractor or Supplier shall not:

1. Have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. Reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.
3. The prohibitions of this Paragraph will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

1.11.03 Electronic Data

[CSI 01 31 26]

1. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner to Contractor, or by Contractor to Owner, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
2. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 30 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 30-day acceptance period will be corrected by the transferring party.
3. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.
4. Computer Aided Design (CAD) files may be made available to the Contractor upon request, but only at the discretion of the Engineer. This includes AutoCAD™, Civil3D™, or other similar file types. If CAD files are provided, no level of accuracy is implied or should be assumed unless the Engineer expressly states a level of accuracy. CAD files by nature include extraneous information used to develop the drawings but are not part of the final design. Any use of CAD files is solely at the Contractor's risk and neither the Engineer nor the Owner take responsibility for interpretations by the Contractor, missing information, or inaccurate information.

1.13 Permits and Licenses

[CSI 01 41 26]

The Owner did not acquire permits for this project as it is a maintenance project.

The Contractor shall acquire and pay all costs for all necessary permits which may include:

- Electrical Permit

1.14 Work Restrictions

[CSI 01 14 00]

The Contractor shall keep at least 2 pumps in operation at any one time. This can include one old and one new pump. The pressure relief valve (existing or proposed) shall be in operation at all times. The pressure tank(s) (1 existing or minimum of 2 of the 3 proposed) shall be in operation at all times.

1.14.19 Use of Site

[CSI 01 14 19]

The Contractor shall not perform work activities, store materials or equipment, move equipment through, or disturb in any way the areas outside the Construction Limits shown unless approved by the Owner in writing.

1.20 PRICE AND PAYMENT PROCEDURES

[CSI 01 20 00]

1.21.29 Quantity Allowances

[CSI 01 21 29]

If more or fewer materials are needed when the construction quantity is within plus or minus 25 percent of the bid quantity, costs for restocking of unused materials, or handling and delivery costs on additional materials shall be incidental to the bid price and no additional payment will be made.

1.21.55 Cost Increases for Materials

[CSI 01 21 55]

There will be no allowance for additional payment should the cost of any materials go up during the original contract timeframe, or during any approved contract time extensions. The Contractor is responsible for securing prices at the time of bid.

1.25.00 Substitution Procedures

[CSI 1 25 00]

Any product or construction method that, in the opinion of the Owner, does not meet these specifications will be considered a substitution. Substitutions must be approved prior to incorporation into the project. The Owner has the right to reject any request for substitution. Incomplete requests will not be reviewed.

Requests shall include an explanation of why the request is being made along with drawings, details, specifications, and samples sufficient to allow the Owner to evaluate the proposed substitute. Requests shall include any change necessary in construction methods with a detailed description and related drawings of the proposed methods. Provide an itemized comparison of each proposed substitution with the specified product or method. If the Contractor believes

there are no variations from the bid documents, include a statement to that fact in the request for substitution.

In making a request for a substitution, the Contractor represents that they have investigated the proposed product or method and has determined that it provides equal or superior form and function to the product specified. The Contractor shall coordinate incorporation of accepted substitutions into the work, making changes that may be required for the work to be completed.

The Contractor waives all claims for additional costs and time related to substitutions. The Owner reserves the right to charge the Contractor for the Owner's time required for incorporating the substitution into the work which may include but not be limited to observation, requests for information, and commissioning.

No guarantee is made that product model numbers included in the specifications or on the plans are current at the time of bidding. The bidder shall provide pricing in their proposal for current versions of discontinued models. If the bidder is uncertain of the correct replacement model, or feels there is a price discrepancy, the bidder shall request a substitution following the requirements of section 1.25.13.10 Substitutions Prior to Bid Opening. Requests for price increases after award will not be accepted.

1.25.13.10 Substitutions Prior to Bid Opening

[CSI 1 25 13 10]

Before opening bids, the Owner may consider written requests from product suppliers or prime bidders for substitutions. All requests for substitution must be received by Owner a minimum of 7 working days prior to bid opening. Approval of substitutions will be only by addendum. The bidder shall include in their proposal all costs for any modifications required to adopt the substitute. Substitutes shall be submitted on the form provided in the appendices.

1.25.13.15 Deviations After Contract Execution

[CSI 1 25 13 15]

After contract execution, the Owner will consider requests for a deviation of products or methods in place of those specified. Submit electronically, or two hard copies of each request for a deviation. Submit requests early enough for the Owner to review the request without affecting the schedule. The Owner will review with reasonable promptness and will provide a response within 15 working days after receipt of all information required for the review, unless the complexity of the proposed deviation requires, in the Owner's sole opinion, additional review time. Deviation requests shall be submitted on the form provided in the appendices.

If the Owner approves a request for deviation, and the Contractor subsequently requests an alternate substitution for the same or similar work, the Owner reserves the right to charge the Contractor for the costs required to review the alternate deviation.

1.30 ADMINISTRATIVE

[CSI 01 30 00]

1.31 Project Management and Coordination

[CSI 01 31 00]

1.31.01 Contractor's Responsibility

[CSI 01 31 01]

The work included in this contract is shown on the contract plans and described in these project specifications. All work incidental and necessary to the completion of the work described and shown shall be performed by the Contractor. In submitting a bid for this project, the Bidder warrants that they are an expert in this and related work, that they understand the process and functions shown, and that various work and processes not shown but necessary for the successful operation of this project will be provided by the Contractor.

The General (or Prime) Contractor is fully responsible for providing the subcontractors and suppliers with all relevant portions of the plans and specifications necessary to bid and construct the improvements.

Damage to existing utilities or property shall be repaired or replaced by the Contractor at the discretion of the Owner.

The Contractor and each of the Subcontractors are responsible for coordinating the required inspections. There are specific requirements for inspection responsibilities and the advance notice that must be given to minimize construction delays. It is the Contractor's responsibility to be familiar with these requirements, include the coordination necessary in this estimate of project costs and schedule, and to comply with the requirements during construction. Failure to follow proper inspection and notification procedures may result in on-site work stoppages and removal or demolition of unapproved structures or systems, all at the Contractor's expense. See Starting and Adjusting section for details.

Do not start work on this project or on any public or private right-of-way or easement until clearance is given by the Owner. It will be the responsibility of the Contractor to comply with the requirements of any permit for the project. Do not hinder private property access without a 24-hour notice to the private property owner, and do not hinder access for more than an 8-hour period. Do not disrupt emergency aid access to private property.

The Contractor is solely responsible for all elements of site safety. Inspections performed by the Owner are only to monitor and record that project plans and specifications are being complied with and construction is consistent with the design intent.

The Contractor is responsible for managing, coordinating, and overseeing its subcontractors, suppliers, manufacturers' representatives, or any other persons performing Work. The Contractor shall designate and have a competent person, familiar with the project and work being performed, on site at all times when work is being performed.

1.31.19 Progress Meetings

[CSI 01 31 19 23]

The Contractor shall schedule and hold regular on-site progress meetings at least every two weeks and at other times as requested by the Owner or as required by progress of the work. The Contractor, Owner, and all Subcontractors active on the site must attend each meeting.

Contractor to provide an agenda covering the following items at a minimum, as applicable.

1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede planned schedule.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Discussion of upcoming required inspections/approvals.
12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Safety issues relating to work.
15. Other business relating to work.

1.32.13 Scheduling of Work

[CSI 01 32 13]

Refer also to the Completion Time section under Supplementary Conditions, 6.1.

Where the plans or specifications mention notification periods in hours or days, these time periods are assumed to be working days unless specifically stated otherwise. For example, a requirement of 48-hours notification for work desired to be performed at 1:00 pm Monday requires notification be provided no later than 1:00 pm the preceding Thursday.

1.32.16 Construction Progress Schedule

[CSI 01 32 16]

Contractor is responsible for providing an up to date construction schedule with prior approval of each monthly pay estimate and at other times as requested by the Owner or as required by progress of the work. If the current schedule is still in-line with the previous schedule, the Contractor shall inform the Owner with each pay estimate. Non-working day

requests shall also be submitted by the Contractor with each monthly pay estimate. Owner may delay monthly progress payments if Contractor fails to submit updated schedule and non-working day requests.

1.32.29 Periodic Work Observation

[CSI 01 32 29]

The Owner may elect to have an observer on site to monitor, observe and record construction progress. The Contractor maintains complete responsibility to verify construction is meeting the design intent and is being constructed in accordance with the plans and specifications. It is not the responsibility of the Owner's observer to address neither means and methods issues nor direct safety issues. The Owner's observer does have the authority to stop work if unsafe conditions are observed.

1.33 Submittals

[CSI 01 33 00]

1.33.23 Shop Drawings, Product Data, and Samples

[CSI 01 33 23]

Submittals are required for all items installed on this contract. Address submittals to:

PUD No. 1 of Skagit County
1415 Freeway Drive
PO Box 1436
Mount Vernon, WA 98273

Attn: Mike Benton, Project Manager

Email: benton@skagitpud.org

If Mike Benton is not available, submittals shall be sent to:

RH2 Engineering, Inc.
4164 Meridian Street, Suite 302
Bellingham, WA 98226

Attn: Kaylie Dennehy

Email: kdennehy@rh2.com

Submittals may be provided in electronic format (preferred) or hard copy and shall be accompanied with the clear delineation of whether the submittal meets the specifications Owner reserves the right to require the Contractor to provide hard-copy submittals at no additional cost to the Owner. When hard-copy submittals are provided, submit three (3) copies; one set will be returned to the Contractor after review.

Electronic submittal via email is acceptable, however the Contractor shall follow up with the Owner to verify that the submittal was received. The Owner assumes no responsibility for emails that do not make it to the recipient. In the case of electronic submittals, only one copy will be returned to the Contractor, either electronically or hard copy at the Owner's discretion.

Submittal data shall contain sufficient information on each item to determine if it complies with the contract requirements. Submittal cutsheets and datasheets shall be annotated by the Contractor to clearly indicate the equipment and materials that will be provided, including any options or additive items. No generic cutsheets or datasheets will be accepted. Each submittal shall be arranged numerically with like-kind components included.

Items installed in the work that have not been approved through the submittal process shall be removed and an approved product shall be furnished, all at the Contractor's expense.

Shop drawing review will be limited to general design requirements only and shall not relieve the Contractor from responsibility for errors or omissions, or responsibility for consequences due to deviations from the contract documents. No changes may be made in any submittal after it has been reviewed except with written notice and approval from the Owner.

Shop drawings shall be submitted on 8½-inch by 11-inch, 11-inch by 17-inch, or 22-inch by 34-inch sheets and shall contain the following information:

- Project Name as it appears on the Document Cover.
- Prime Contractor and Applicable Subcontractor.
- PUD No. 1 of Skagit
- RH2 Engineering.
- Applicable Specification and Drawings Reference.
- A stamp or statement that the Contractor has checked the equipment for conformance with the contract requirements, coordination with other work on the job, and dimensional suitability.
- A place for the Engineer to respond. (Engineer may elect to respond using the Engineer's standard forms.)

Submittals that do not comply with these requirements may be returned to the Contractor for re-submittal. The Contractor shall revise and resubmit as necessary. Acceptable submittals will be reviewed as promptly as possible and transmitted to the Contractor not later than 14 working days after receipt by the Engineer. Delays caused by the need for re-submittal shall not be a basis for an extension of contract time or delay damages.

Shop drawings and submittals shall contain the following information:

1. Drawings, dimensions, and weights.
2. Catalog information.
3. Model number, including descriptions for option and accessory codes.
4. Manufacturer's specifications.
5. Special handling instructions.
6. Maintenance requirements.
7. Wiring and control diagrams.
8. List of contract exceptions.

For integrated or package systems (see also 1.61.31), the components, shop drawings, instructions, and other elements may be submitted and reviewed individually. But the initial submittal must include the complete proposed system, and the final submittal must also be for the complete system clearly indicating all changes made during the submittal process.

The Contractor warrants that they have determined and verified all field measurements, field construction criteria, materials, catalog numbers, and similar data, and have checked and coordinated each submittal with the requirements of the work and of the contract documents.

The Owner will pay the costs and provide review services for a first and second review of each submittal item. Additional reviews shall be paid by Contractor by deducting up to $200 for each hour of review time from the next scheduled payment.

For follow-up submittals, the Engineer will review only those items noted for revision in the preceding review. If the Contractor has modified the submittal in any other way, such modifications must be clearly identified both on a cover transmittal and within the submittal itself.

The Contractor is responsible for identifying the shop drawings and submittals required for this project. Specific submittal requirements may be listed in each section of these specifications. Contractor shall keep a complete and up to date copy of all submittals and review responses at the job site readily available to the Owner for inspection.

1.40 QUALITY REQUIREMENTS

[CSI 01 40 00]

1.42.19 Reference Standards

[CSI 01 42 19]

Work under this contract shall be performed in accordance with applicable sections of the current Standard Specifications for Road, Bridge and Municipal Construction, American Public Works Association, and Washington State Department of Transportation, hereafter referred to as the Standard Specifications.

Certain other referenced standards used in this specification are from the latest editions of:

- PUD No. 1 of Skagit County Standards
- Skagit County Municipal Code
- IBC International Building Code
- UPC Uniform Plumbing Code
- IMC International Mechanical Code
- IFC International Fire Code
- NEC National Electrical Code
- AWWA American Water Works Association
- ANSI American National Standards Institute

- ASA American Standards Association
- ASTM American Society for Testing and Materials
- WSEC Washington State Energy Code

1.43.20 Warranty

[CSI 01 43 20]

The Contractor shall warrant all work and products for a period of one (1) year following the warranty start date except for those components and listed warrantees below.

The warranty start date is the date the final payment (not retainage payment) is sent to the Contractor from the Owner.

Warranty does not cover damage due to misuse by the Owner or conditions outside of the Owner or Contractor's control or exceptional events (force majeure) including war, strikes, floods (water exceeding normal high water mark), rainfall in excess of 100 year storm event, fire, earthquakes, high winds (over 85 mph for 3 seconds peak gust), freezes below 10 degrees Fahrenheit (Western Washington), freezes below minus 10 degrees Fahrenheit (Eastern Washington), governmental restrictions, vandalism, utility power failures, or utility power surges (unless due to Contractor provided surge suppressor failure). The Contractor has control over workmanship, third party subcontractors and parts and materials used to complete the project.

Warranties in addition to this warranty are listed in the following sections:

- Division 11.10.05 Pumps
- Division 11.20.1 Pump motors

1.45.16 Field Quality Control Procedures

[CSI 01 45 16]

Unless otherwise noted on the plans or within these specifications, provide 48-hour notice to the Owner and appropriate reviewing agency for all inspections required. 48-hour notice is defined as two complete working day notice. Time is not counted on weekends and holidays (inspections required on a Monday or the day after a holiday shall be scheduled a minimum of 48 hours in advance not including the holiday hours or weekend hours.)

Contractor shall schedule and arrange for the following inspections and tests with the Owner:

- Pressure testing
- Pump testing
- Water quality testing

1.50 TEMPORARY FACILITIES AND CONTROLS

[CSI 01 50 00]

1.51 Temporary Utilities

[CSI 01 51 00]

Provide all necessary water for construction-related fire protection and utilities required by this contract, or by laws and regulations. Sanitary facilities adequate for all workers shall comply with all codes and regulations.

At the close of this contract, the Contractor shall pay all utility bills that are outstanding, remove all temporary electrical, sanitary, telephone and water facilities, and any other temporary service equipment that may remain.

Temporary electrical power is available at the site. The Contractor may use existing power facilities in the Pump Station.

Temporary water is available at the site. The Contractor may use existing water taps connected to the suction or discharge side of the W and SW Pumps.

1.52.00 Construction Facilities

[CSI 01 52 00]

Construct and locate all field offices, all necessary gates and barricades, fences, handrails, guard rails, and securities required by this contract, or by laws and regulations. Provide shelters and dry facilities for the workers as required. Provide all guards, marks, shields, protective clothing, rain gear, and other equipment required by law, ordinance, labor contracts, Occupational Safety and Health Administration (OSHA) regulations, and other regulations for the maintenance of health and safety. Provide first aid kits and equipment as required by law.

1.52.20 Locks and Keys

[CSI 01 52 20]

Contractor may provide temporary locks at their discretion. Contractor shall provide Owner with two construction key(s) for all temporary locks. Owner may "double lock" any padlocks at their discretion.

The Owner will provide permanent padlocks.

If the Owner provides a key to the Contractor for existing Owner locks, the Contractor will be responsible for the key until returning it to the Owner. If the Contractor loses the key, the Contractor will pay for re-coring of all Owner locks that use that key at no additional cost to the Owner.

1.54 Construction Aids

[CSI 01 54 00]

The Contractor or product manufacturer may include work, materials, or components to aid in shipping, storage, installation, or other work for their convenience. Such items shall be

removed prior to final project acceptance if they may interfere with the operation or maintenance of permanent work. Some examples include, but are not limited to:

- Lifting eyes: Remove only if a safety concern, obstruction, or directed by Owner.
- Picking holes: Plug holes of buried and exterior items, or if safety concern.
- Intermediate or shipping bracing: Remove and dispose.
- Protective shipping adhesives, coatings, or covers: Remove and clean residue.

1.60 PRODUCT REQUIREMENTS

[CSI 01 60 00]

1.61.31 Integrated (or Package) Products

[CSI 01 61 31]

Products specified as integrated or packaged must be administered with a single point of responsibility from a producer who regularly furnishes such products and is qualified to address and resolve issues during submittals, fabrication, installation, commissioning, and operation. These responsibilities will not be transferred to any other party without written approval by the Engineer. Products that fall under this category may include but are not limited to the following (when specified as packaged or integrated).

- Pumps and Motors
- Motor Control Centers

1.70 EXECUTION AND CLOSEOUT REQUIREMENTS

[CSI 01 70 00]

1.71 Examination and Preparation

[CSI 01 71 00]

1.74 Cleaning and Waste Management

[CSI 01 74 00]

1.74.13 Progress Cleaning

[CSI 01 74 13]

If an area of the project will be left idle, or minimal work performed for more than one calendar week, the Contractor shall clean up the area prior to moving. In this context, clean-up means: stockpiles and materials shall be removed so as not to be an obstruction or hazard; surfaces cleaned to the satisfaction of the Owner.

1.74.23 Final Cleaning

[CSI 01 74 23]

All areas impacted by the work shall be restored to at least original condition, unless specifically identified otherwise in the plans or specifications. All costs are incidental.

Clean up debris and unused material and remove from the site and any buildings. If vehicle traffic causes ruts, repair asphalt (new or existing) in paved areas. In non-traffic areas back track with dozer or excavator and repair to final surface condition including necessary hydroseed, mulch, and landscaping. Eliminate weeds within the construction area prior to project closeout.

Buildings shall be broom clean and all foreign damage or markings removed or repaired.

Equipment shall be washed clean using appropriate methods.

Unpainted exposed concrete structures shall be cleaned to a consistent bare concrete surface finish. Remove extraneous substances such as efflorescence, leakage residue, and excess repair materials.

Remove existing equipment or materials identified in the contract documents or that interfere with the work. Dispose of all such existing equipment or materials unless the Owner requests items to be salvaged for their use. Owner has first right of salvage.

Should the Owner identify salvageable items of their property prior to removal, the Contractor shall protect said items from damage during the work and will be responsible for reimbursing the Owner should the Contractor damage the items. In addition, remove the following items, intact and operational, and set aside for the Owner:

- Valves
- Pumps and Motors
- Fittings

1.75 Starting and Adjusting

[CSI 01 75 00]

1.75.16 Startup Procedures

[CSI 01 75 16]

1.75.16.10 Startup

[CSI 01 71 16 10]

See the Automatic Control section for control system startup.

Startup shall consist of a simulated operation of all equipment and controls. The purpose of startup shall be to check that all equipment will function under operating conditions, that all interlocking controls and sequences are properly set, and that the facility will function as an operating unit.

Startup shall not occur on a Saturday, Sunday, Monday, Friday, on an Owner recognized holiday, or the day before or after an Owner recognized holiday unless approved in advance by the Owner.

Technically qualified product representatives shall be present for the startup phase. All representatives shall be trained, qualified, and have experience in troubleshooting and fixing field issues. The startup shall continue until it is demonstrated that all functions, controls, and equipment are functioning correctly.

Authorized manufacturer's representatives shall be provided for the following items:

- Pumps and motors
- Pilot-operated hydraulic control valves
- Variable frequency drives
- Motor control centers (electrician may qualify if approved by manufacturer)
- Field sensors (electrician may qualify if approved by manufacturer)

1.75.16.12 Startup and Testing Coordination

[CSI 01 75 16 12]

The Contractor shall conduct all testing and startup. Testing and startup shall not be a cause for claims for delay by the Contractor and all expenses for testing and startup shall be incidental to this contract.

The placing of all improvements in service shall consist of three parts: "testing", "startup", and "operation". Not less than 21 calendar days before the anticipated time for beginning testing, the Contractor shall notify and submit to the Owner for approval, a complete plan for the following:

1. Schedules for tests:

A. Telemetry Panel Factory Demonstration Test (at panel shop)

B. Pumps and motors

C. Control system

D. Meter calibration

2. Detailed schedule of procedures for startup.
3. Complete schedule of events to be accomplished during testing.
4. An outline of work remaining under the contract that will be carried out concurrently with the operation phases.

Failure to provide proper notification to the Owner may lead to liquidated damages if schedule cannot be maintained. If rescheduling is required because components are not ready for testing, the notification requirements are reset as needed to provide 21 calendar days advance notice to reserve the Owner Representatives' time.

The Contractor shall arrange for all materials, supplies, and labor necessary to efficiently complete the testing, startup, and operation. Measuring devices must be functional, accurate, legible, and scaled appropriately for the test. The Owner has the right to reject or require verification for any measuring device the Owner suspects in its accuracy.

At a minimum, the Contractor shall provide:

- Calibrated pressure gauge(s) (max scale of 120% to 200% of test pressure)
- Voltmeter
- Amp meter.
- Pump/motor vibration measuring device (inches per second and inch peak to peak)

1.75.16.20 Testing

[CSI 01 75 16 20]

The Contractor may periodically request preliminary testing for items that must be covered or tested before other work can proceed. In these cases, do not cover up or test the work without timely notice to the Owner of its readiness for testing. Should any work be covered up without notice, approval, or consent, it must, if required by the Owner, be uncovered for examination at the Contractor's expense. All necessary equipment shall be set up and the work given a preliminary test so that defects may be discovered and repaired prior to calling out the Owner to witness the test.

Final testing consists of individual tests and checks made on equipment intended to provide proof of performance, operation, and control in the presence of the Owner. Assure proper alignment, size, condition, capability, strength, adjustment, lubrication, pressure, hydraulic test, leakage test, and all other tests deemed necessary by the Owner to determine that all materials and equipment are of specified quality, properly situated, anchored, and in all respects ready for use. Any certificates required in these specifications by the manufacturer's representatives shall be supplied to the Owner prior to startup.

All piping shall be tested as required by specifications and applicable codes. Tests on individual items of equipment shall be as necessary to show proper system operation. During testing, the Contractor shall correct any defective work discovered. Startup shall not begin until all tests required by these specifications have been completed and approved by the Owner.

Not less than five working days before the anticipated time for beginning the testing, the Contractor shall provide a list of representatives that will be attending the testing. The Owner may request additional representatives at no additional cost if said representatives are identified in these specifications.

Qualified product representatives to be on site for the following equipment, at a minimum:

- Pumps and motors
- Pilot-operated hydraulic control valves
- Motor Control Centers

Qualified product representatives are to be on site for startup and testing of specific pieces of equipment. Representatives required are listed in the relevant specification sections.

1.75.16.22 Scheduling of Owner Review for Testing

[CSI 01 75 16 22]

See Division 1.75.16.12 for scheduling and notification requirements.

The Contractor shall provide notification two working days and two working hours (to confirm readiness) before the scheduled test(s) to the Owner confirming that the Contractor has successfully completed all preliminary testing and that all equipment, tools, materials, labor, subcontractors, manufacturer's representatives, and all other items required for witnessed testing are available and fully functional. Failure to provide advance notification and confirmation or meet any of the testing requirements will constitute a failed test in accordance with the section Inspection and Tests of the General Conditions.

A detailed testing schedule shall be provided by the Contractor for factory and onsite testing and updated as needed to be at least 2 working days ahead of actual testing. The Contractor must have all systems pre-tested prior to calling the Owner for formal testing.

Schedule shall include control system testing starting on Mondays or Tuesdays so that the remainder of the week can be used to identify the stability of the control system for the SCADA system and pump station. Control system testing shall not start on a Thursday, Friday, or the day before an Owner recognized holiday.

1.75.16.32 Pump Testing

[CSI 01 75 16 32 or 33 08 00]

See the applicable pump sections of these specifications for pump testing requirements.

1.75.16.40 Electrical and Control Systems Testing

[CSI 01 75 16 40 or 25 08 00 or 26 08 00]

See also the applicable electrical sections for electrical system testing.

See also the applicable automation sections for automatic control system testing.

The following is a list of components that shall be tested prior to project completion. This list is intended as a general guide and is not necessarily complete:

- Pressure sensors and alarms
- Flow sensors and alarms
- Temperature sensors and alarms
- Variable speed drives

1.78 Closeout Submittals

[CSI 01 78 00]

1.78.23 Operation and Maintenance Data

[CSI 01 78 23]

Failure to provide acceptable final documentation including operation and maintenance (O&M) manuals and as-built drawings will result in non-payment of the appropriate bid item in the schedule of prices.

Remove and preserve all tags and instructions that come packaged with or attached to equipment. Deliver all such documents to the Owner bound in a three-ring binder or with the O&M Manual. Insert documents in sleeves if they cannot be punched. Scan all such documents to Adobe PDF format and provide with the O&M Manual.

Prior to the receipt of payment for more than 90 percent of the work, deliver to the Owner acceptable manufacturer's instructions covering equipment and systems O&M procedures, for coatings furnished under this contract, and any additional items indicated by the Owner.

At a minimum, provide O&M information for the following:

- Pumps
- Motors
- VFDs
- Control Valves
- Meter

The operating and maintenance instructions shall include, as a minimum, the following data for each coating and equipment item:

Products

A. Identification including brand name, model number, and serial numbers.

B. Date of manufacture and date of installation on job site.

C. Complete as-built elementary wiring and one-line diagrams.

D. Complete parts list, by generic title and identification number, complete with exploded views of each assembly.

Maintenance

A. Recommended spare parts.

B. Lubrication schedule including the applicable lubricant designation available from the Standard Oil Company of California.

C. Recommended preventive maintenance procedures and schedules. Schedule shall be provided for daily, weekly, monthly, quarterly, semi-annually and annually for maintenance.

D. Disassembly and re-assembly instructions including parts identification and a complete parts breakdown for all equipment.

E. Weights of individual components of each item of equipment weighing over 50 pounds.

F. Name, location, and telephone number of the nearest suppliers and spare parts warehouses.

G. All manufacturers' warranties. Include name, address, and telephone number of the manufacturer's representative to be contacted for warranty, parts, or service information.

H. Cleaning, repair, and maintenance instructions for each coating system.

I. Provide USB flash drive or DVDs utilized in the manufacturer's instruction program.

Operation

A. Recommended trouble-shooting and startup procedures.

B. Recommended step-by-step operating procedures.

C. Emergency operation modes, if applicable.

D. Normal shutdown procedures.

E. Long term shutdown (mothballing) procedures.

F. Equipment specifications and guaranteed performance data.

G. General manuals which describe several items not in the contract will not be accepted unless all references to irrelevant equipment are neatly eradicated or blocked out.

Provide three (3) hard copies of O&M manuals (three (3) for Owner). A duplicate USB or DVD copy shall also be provided but shall not substitute for a hard copy unless approved by the Owner.

Bind each set of instructions into multiple volumes; each volume to be complete with an index and bound in a suitable, hard-covered binder. Binders shall be hardback construction with full-length metal hinge. 3-inch to 5-inch width as appropriate for the quantity of O&M documentation. More than one binder may be required for large projects. Binders equal to Wilson-Jones WLJ344 series or WLJ369 series or Specialty Loose Leaf models 87784, 98085, 98086, or 98984.

Manuals shall be assembled and indexed so that information on each coating and piece of equipment can be readily found.

At the Owner's discretion, progress payments for more than 90-percent of the total contract work may not be made until the O&M manual has been delivered and approved by the Owner.

The Contractor shall secure and deliver to the Owner all equipment warranties and other warranties and guarantees required for all equipment and processes. Delivery shall be done at one time covering all major and minor equipment warranties. Copies of the warranties shall be included in each O&M Manual.

See Division 1.43.20 for details regarding required warranties for specific components.

1.78.39 Project Record Documents

[CSI 01 78 39]

Prior to receiving final payment for the work, deliver a complete set of "As-Constructed" records (also called as-built, or record plans) to the Owner. The Owner has sole discretion to determine if the records provided are legibly and accurately presented and may request revisions, which shall be provided by the Contractor at no additional cost. Records shall be made as follows or as approved by the Owner:

- Yellow markings or highlights = deleted items
- Red markings = new or modified items

Records shall be provided in PDF format.

Provide "as-constructed" information on all items and work shown on the plans showing details of the finished product including dimensions, locations, outlines, changes, manufacturers, etc. The information must be in sufficient detail to allow the Owner's personnel to locate, maintain, and operate the finished product and its various components.

The Contractor shall submit copies of preliminary as-constructed records documenting the previous month's work with each pay request. Preliminary records shall consist of photocopies/scans of field notes and redlined drawings and shall contain sufficient detail to accurately locate the horizontal and vertical location of all permanent improvements based on an established and consistent control point(s). Failure to provide complete and accurate preliminary as-built information will constitute grounds for withholding progress payments.

See also electrical plan requirements in Division 16.05.

1.79 Demonstration and Training

[CSI 01 79 00]

1.79.10 Training

[CSI 01 79 10]

See the Automatic Control section for automatic control systems training.

At the time that the facility is ready to be put into operation, the Contractor is to conduct an operation and maintenance training meeting with the Owner to explain in detail the operation and maintenance requirements of each of the facility's components. The training meeting shall not occur on the same days as a startup.

Operation of the facility shall commence immediately after completion of testing, startup, and training and after satisfactory repairs and adjustments have been made.

1.80 PERFORMANCE REQUIREMENTS

[CSI 01 80 00]

1.81 Facility Performance Requirements

[CSI 01 81 00]

1.81.40 Pressure Ratings

[CSI 01 81 40]

Fittings, valves, pipe, and other fluid systems shall have pressure ratings equal to or greater than the pressures identified herein, unless specifically called out otherwise in the plans or specifications. Pressures listed are gauge pressure, unless specified otherwise.

The pressure class of pipelines and appurtenances shall comply with the Owner's standards for minimum pressure class or the pressure class that meets the requirements of this section, whichever is greater.

Equipment Type or Function	Working Pressure	Test Pressure
W Pumps and Panorama Zone Water System	130 psi	230 psi
Pressure Tanks	130 psi	146 psi

Working Pressure: Manufacturer's rating of maximum pressure during extended operation.

Test Pressure: Maximum pressure during project specific testing.

1.81.45 Location Designations

[CSI 01 81 45]

The following location designations shall be used except where otherwise noted on the plans:

Dry Locations: Indoor continually dry areas including office, laboratory, blower, and electrical rooms.

Wet Locations: All locations exposed to the weather, whether under a roof or not, or within channels, basins or tanks.

Damp Locations: Process areas; areas containing pumps, valves, and major piping; all spaces wholly or partially underground, or having a wall or ceiling forming part of a channel or tank, unless otherwise designated on the Plans. Any areas which do not fall within the definitions for dry, wet, or corrosive shall be considered damp.

Immersed or **Submerged Locations:** Areas which are periodically, or continuously submerged in, or contain a liquid.

1.81.50 Materials in Contact with Domestic Water

[CSI 01 81 50]

All devices, components, and materials substantially in contact with potable water shall be certified by NSF International to comply with NSF/ANSI 61 (leachable materials) and NSF/ANSI 372 (lead content). Certification of compliance shall be supplied in writing at the time of the submittal process. See exceptions in WAC 246-290-220(1).

3.00 GENERAL

Sections in these specifications titled "*Common Work for . . .*" apply to all following subsections whether directly referenced or not.

3.05 Common Work for Concrete

[CSI 03 05 00]

Part 1 - General

This division covers that work necessary for furnishing and installing all concrete as described in these specifications and as shown on the Plans.

Submittals

Submittal information shall be provided to the Owner for the following items:

- Grouts
- Concrete mix design including aggregate gradation and substantiating strength data.
- Concrete anchors

Concrete mix designs shall be submitted to the engineer for approval a minimum of two weeks prior to placing any concrete. The mix design shall include the amounts of cement, fine and coarse aggregate, water and admixtures, as well as the water cement ratio, slump, concrete yield, aggregate gradation, and substantiating strength data in accordance with ACI 318, Chapter 5. Review of mix submittals by the engineer of record indicates only that information presented conforms generally with contract documents. Contractor or supplier maintains full responsibility for specified performance.

Part 2 - Products

Components

Nominal maximum size for aggregates is the smallest standard sieve opening through which the entire amount of aggregate is permitted to pass. Provide intermediate aggregate grades as required to achieve a well-graded mix.

All concrete surfaces exposed to weather or standing water shall be air entrained. Total air content shall be in accordance with IBC requirements unless specified otherwise herein. Air shall be measured at the truck, unless otherwise agreed to.

Water used in concrete shall be potable.

Fly ash may be substituted for up to 15 percent of the required cement, except where noted.

Mixes

Concrete shall be mixed, conveyed, and proportioned in accordance with IBC section 1905.

The concrete mix shall include the amount of cement, fine and coarse aggregate, including aggregate gradations, water, and admixtures as well as water cement ratio, slump, concrete

yield, and sustaining strength data in accordance with these specifications, the requirements of the International Building Code Section 1905, and the requirements of ACI 318.

Part 3 - Execution

Inspection

See Statement of Special Inspections on the Drawings for special inspection requirements. Provide two (2) full working day notice to Owner prior to needing the required inspections.

Also comply with local building department and permit requirements for inspection and notification.

The Contractor shall repair, replace or modify, as appropriate, any items noted in the Special Inspector's inspection or the building department inspection.

Testing

Testing will not be required. If cracks appear at pump testing, startup or initial operation, the contractor shall repair or replace the concrete per Owner direction at no additional cost to the Owner. If concrete requires repair or replacement, the following shall be required for the grout repair or concrete replacement:

Concrete strength tests shall be performed per section 1903 of the 2021 IBC and per the requirements noted herein. Strength tests shall be required regardless of the volume poured. The Owner will provide and pay all costs of concrete testing. The Engineer shall be furnished with copies of all inspection reports and test results.

Cylinders used for concrete strength tests shall be 6 by 12. Four by 8 cylinders may be used for mixes with maximum aggregates less than 1-inch, however the testing lab must apply a 0.94 multiplier to the compressive strength test results unless data acceptable to the Engineer is presented that would justify a higher multiplier. All mixes utilizing aggregates over 1 inch shall be tested using 6 by 12 cylinders.

When 4 by 8 cylinders are utilized AASHTO T23 requirements shall be followed, and the retainer used with neoprene pads when testing for compressive strength shall be constructed according to ASTM C1231.

The Contractor will coordinate all concrete testing with the testing agency. Costs will be paid by the Owner.

Give the Owner and testing agency 48-hour notice prior to concrete placement. If Contractor fails to provide the required notice, the Owner may elect to cancel the affected concrete placement. Contractor shall be responsible for costs and delays due to improper notification.

If the Contractor schedules a concrete placement and does not notify the Owner and testing agency of a cancellation within 24 hours of the scheduled placement, the Contractor shall pay the testing agency costs for an unnecessary trip. If the Contractor fails to provide the testing agency with adequate notification and testing agency cannot attend concrete placement, Contractor shall reschedule placement. Contractor shall be responsible for all associated delays.

The Contractor shall provide all assistance and cooperation necessary to testing personnel to obtain the required concrete tests. Contractor and Owner will have access to testing results as soon as they are available.

The testing agency shall take a minimum of four samples for each concrete pump base; one for a 3-day test, one for a 5-day test, one for a 7-day test, and one for backup testing in case the other three samples do not meet design strength. Additional samples may be taken to verify strength prior to form removal at the Contractor's expense. The contractor will be required to provide testing data demonstrating the concrete has met the 28-day compressive strength prior to installation of pump and anchors.

3.15.19 Concrete Anchors

[CSI 05 05 19 (drilled)]

Part 2 - Products

Materials

Concrete Anchors shall be Hilti HIT 500-V3, Simpson SET-XP, or Powers PE1000+ Adhesive Anchors.

Part 3 - Execution

Installation

Install in accordance with Manufacturer's recommendations. Special Inspection in accordance with IBC, Section 17, must be provided. Provide a minimum of 48 hours' notice to Engineer prior to starting installation. Concrete anchors shall not be used to resist tension or fatigue loading without Owner's evaluation and approval.

Use threaded rod meeting Manufacturer's recommendations. Provide minimum embedment per manufacturer requirements. Holes shall be drilled with carbide-tipped drill bit. Holes shall be cleaned of dust and debris. Adhesive shall be inserted with a mixing nozzle.

3.31.30 Thrust Blocks, Driveways, Curb, Gutter, Sidewalks, Equipment Pads, and Fence Posts

[CSI 03 31 13.10]

Part 1 - General

Summary

All concrete for non-structural applications including thrust blocks, driveways, sidewalks, equipment pads, and fence post foundations. Hydraulic or Structural Concrete may be substituted.

Performance Requirements

28-day compressive strength – 4,500 psi minimum

Part 2 - Products

Mixes

Water/cement ratio - 0.45 maximum

Nominal maximum aggregate size – ¾-inch (AASHTO Grading No. 67)

Entrained air ratio – 3.5 percent minimum to 6.5 percent maximum

3.20 REINFORCING

[CSI 03 20 00]

3.21 Reinforcement Bars

[CSI 03 21 00]

3.21.11 Plain Steel Reinforcement Bars

[CSI 03 21 11]

Part 1 - General

References

ACI – American Concrete Institute- latest edition

CRSI Manual of Standard Practice – latest edition

Part 2 - Products

Materials

Grade – ASTM A706, Grade 60

ASTM A615, Grade 60 shall be permitted if:

(a) The actual yield strength based on mill tests does not exceed fy by more than 18,000 psi; and,

(b) The ratio of actual tensile strength to the actual yield strength is not less than 1.25.

Detailing - ACI 318 and ACI 315

Lap requirements - See schedule on Plans or as required by ACI 318

Tie wire - 16 gauge minimum

Bar supports shall conform to "Bar Support Specification" CRSI Manual of Standard Practice, MSP-1-80. Provide Class 1, plastic protected bar supports. Use pre-cast concrete blocks to support bars off ground. Bar supports in water holding and buried structures shall be non-metallic.

Part 3 - Execution

Installation

Reinforcing steel shall be detailed in accordance with ACI 315and 318 and as shown on the Plans. Bend wire bar ties away from formwork to provide the same concrete clearance as shown on the Plans to the bars.

Welding of reinforcing steel shall not be performed unless specifically approved by the Engineer. If approved, Contractor will arrange and pay for all required Special Inspections associated with welding of reinforcing steel.

Field Quality Control

Reinforcing steel shall be free of rust and loose scale at time of concrete placement. Bars with kinks, improper bends, or reduced cross-section due to any cause will not be used. Bars shall not be field bent. Bars may not be tack-welded or otherwise heated.

If, within the project warranty period, rust spots appear on the concrete due to failure to achieve proper clearance on the rebar or wire ties, the Contractor shall grind out and patch the areas using a method satisfactory to the engineer.

3.60 GROUTING

[CSI 03 60 00]

3.62 Non-Shrink Grouting

[CSI 03 62 00]

3.62.13 Non-Metallic Non-Shrink Grout

[CSI 03 62 13]

Part 1 - General

Summary

Use Precision Non-Shrink Grout for grouting all equipment base plates, pipe supports, and base plates for metalwork. Precision Non-Shrink grout may also be used for all other non-shrink grouting operations. General Purpose Non-Shrink grout may be used for any applications other than those noted for Precision Non-shrink Grout. Non-shrink grout shall be used to seal all new pipe and conduit penetrations (watertight) into and out of all concrete and CMU block walled structures.

Storage and Handling

Stockpile grout to prevent contamination from foreign materials and store admixtures to prevent contamination or damage from excess temperature change

Part 2 - Products

Materials

Precision Non-Shrink Grout:

Provide a high-precision, fluid, non-shrink, quartz or non-catalyzed metallic aggregate grouting material. Provide a ready-to-use grout that hardens free from bleeding, settlement, or drying shrinkage when mixed, placed and cured at any consistency – fluid, flowable, plastic or damp-pack.

Provide precision, non-shrink natural aggregate grout that when cured produces the following properties:

A. Compressive Strength at fluid consistency (ASTM C109-Modified): 3500 psi (24 MPa) at 1 day, 7500 psi (52 MPa) at 28 days.

B. Passes ASTM C1107 as a grade B grout when tested as temperature minimum and maximums of 45 degrees Fahrenheit to 90 degrees Fahrenheit (8 degrees Celsius to 32 degrees Celsius) at a working time of 30 minutes. Grout must be tested at a fluid consistency per ASTM C939 and remain fluid at temperature range minimum and maximums for the 30-minute working time. All materials including water must be mixed and tested at temperature minimum/maximums.

C. Modulus of Elasticity at 28 days at fluid consistency (ASTM C469): 3.0 x 10^6 psi (20.7 GPa) minimum, 3.9 x 10^6 (27.0 GPa) maximum.

D. Coefficient of Thermal Expansion for fluid consistency (ASTM C531): 7.5 x 10^{-6}/ degrees Fahrenheit maximum (13.5 x 10^{-6}/ degrees Celsius).

E. Flexural strength at 28 days for fluid consistency (ASTM C78): 1300 psi (7.9 MPa).

F. Resistance to rapid freezing – thawing (ASTM C666, Procedure A): 300 cycles- min RDF 90 percent.

G. Split tensile strength at 28 days at fluid consistency (ASTM C496): 450 psi (3.1 MPa).

H. Pass 24-hour grout test under stated temperature, time and fluidity constraints. See MBT Protection and Repair 24-hour Grout Form.

Precision non-shrink grout shall be MasterFlow 928 or 885 Grout or approved equal.

General Purpose Non-Shrink Grout:

General Purpose Non-shrink grout shall meet the compressive strength and nonshrink requirements of CRD-C 621, Grades B and C; Corp of Engineers Specification for Non-shrink grout; and ASTM C1107, Grades B and C. General Purpose Non-shrink grout shall be MasterFlow 713, Dayton Superior 1107 Advantage, or approved equal.

Provide curing compounds as recommended by the grout manufacturer.

Water to be used in mixing the grout shall be potable.

Mixes

Comply with grout manufacturer's recommendations for mixing procedures.

Adjust water temperature to keep mixed grout temperature in the range of 45 degrees Fahrenheit (7 degrees Celsius) and 90 degrees Fahrenheit (32 degrees Celsius) minimum/maximum.

Use cold or iced water to extend working time in hot weather or in large placements.

Use warm water in cold conditions to achieve minimum as mixed temperatures.

Part 3 - Installation

Preparation

Mechanically remove unsound concrete within the limits of the grout placement.

Remove at least ¼-inch (6mm) of existing concrete facing and continue removal as required to expose sound aggregate.

Thoroughly clean the roughened surface of dirt, loose chips, and dust. Maintain substrate in a saturated condition for 24 hours prior to grouting. Surface should be saturated surface dry at time of grouting.

Clean baseplates and other metal surfaces to be grouted to obtain maximum adhesion. Remove loose rust and scale by grinding or sanding.

Comply with grout manufacturer's recommendations for form construction. Construct forms to be liquid tight.

Installation

Place grout mixture into prepared areas from one side to the other. Avoid placing grout from opposite sides in order to prevent voids. Work material firmly into the bottom and sides to assure good bond and to eliminate voids.

Ensure that foundation and baseplate are within maximum/minimum placement temperatures. Shade foundation from summer sunlight under hot conditions. Warm foundation when foundation temperature is below 45 degrees Fahrenheit (7 degrees Celsius).

Wet cure exposed shoulders for 48 hours followed by two coats of curing compound for best results. The minimal requirement is to wet cure until grout has reached final set, followed by two coats of curing compounds.

9.00 GENERAL

This division covers work necessary for providing all materials, equipment, and labor to coat all items in accordance with these specifications.

Sections in these specifications titled *"Common Work for . . ."* apply to all following subsections whether directly referenced or not.

9.90 PAINTING AND COATING

[CSI 09 90 00]

9.90.05 Common Work for Painting and Coating

[CSI 09 90 05]

Part 1 – General

Scope

The work specified in this Section covers the furnishing and installation of protective coating, complete in place. Shop coating and/or factory applied finishes on manufactured or fabricated items may be specified elsewhere. Regardless of the number of coats previously applied, at least two coats of paint shall be applied in the field to all coated surfaces unless otherwise specified herein.

Submittals

Before beginning any painting or coating, submit a list of coatings and manufacturers for review by the Owner. Include the application each coating is intended for, any surface preparation, number of coats, method of application, and coating thickness.

Provide color choices with physical cards prepared by the coating manufacturer. Electronic (PDF, jpg, etc.) charts, and charts made from office printers or copiers are not acceptable. If the Owner elects to make preliminary selection from an electronic or printed chart, the Contractor must provide physical samples of the colors selected for the Owner's approval.

Provide Safety Data Sheets (SDS) for all materials including solvents. Provide NSF certification for finishes in potential contact with potable water. Submit this information according to the requirements regarding shop drawings included herein.

Provide a schedule of coating operations and inspection timing. Coating inspections will be scheduled based upon Contractor-provided schedule, update schedule weekly or as necessary.

Provide manufacturer's approval of coating system applicator.

If submitted products are manufactured by a company other than the specified reference standard, provide complete comparison to specified projects including application procedures, coverage rates, and verification that product is appropriate for intended use. Provide information that demonstrates the submitted products are equal to the performance standards of products manufactured by Tnemec Corporation, which is the reference standard.

Performance Requirements

All finishes potentially in contact with potable water shall be National Sanitation Foundation (NSF) 61 or 600 certified for contact with potable water. Certification from the NSF or UL shall be supplied in writing at the time of the submittal process for Finishes. Verify the submitted coatings' current NSF requirements, restrictions, and applicability to the coated items. Verify finishes used on the project are compliant with primary and secondary standards of the Safe Drinking Water Act. Any violation shall be remedied at the Contractor's expense.

The completed coating shall produce a minimum dry film thickness in accordance with the specifications as determined by the microtest thickness gauge or comparable instrument. In areas where this thickness is not developed, sufficient additional coats shall be applied to produce it.

Quality Assurance

The Contractor is responsible for compatibility of all shop and field applied paint products including the use of primer, intermediate, and top coats by different manufacturers if applicable. For any Contractor initiated substitutions, the Contractor shall verify complete compatibility between coatings provided for the project. If coatings are not compatible per manufacturer's review it is the Contractor's responsibility to remove incompatible coatings fully and replace with compatible coating systems.

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.

The Contractor is responsible for obtaining written documentation from equipment/material manufacturers regarding the date at which shop prime coatings are applied and shall strictly adhere to the coating manufacturer's recommendations for recoat time intervals. The Contractor shall submit to the Owner such documentation upon request.

Storage and Handling

Bring all materials to the job site in the original sealed and labeled containers of the paint manufacturer. Materials are subject to inspection by the Owner. Store paint supplies as recommended by the manufacturer and as approved by the Owner.

Extra Materials

Waste Products

Collect, contain, transport, and dispose all waste products generated for this project. Cleaning and disposal shall comply with all federal, state, and local pollution control laws. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.

Cleaning and disposal shall comply with all federal, state, and local pollution control laws. Provide appropriate containers for collection and disposal of waste, debris, and rubbish.

Part 2 – Products

Manufacturers

The following coating system manufacturers are approved subject to compliance with the Specifications contained herein:

1. Tnemec Company
2. Sherwin Williams
3. International Paint (AkzoNobel)
4. Or Equal

The specified coating establishes the type and quality of the coating desired. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Owner to determine that the coatings proposed are equivalent to those named. Proposed coating shall be submitted for review in accordance with Division 1. Requests for review of equivalency will not be accepted from anyone except the Contractor.

Substitutions of the coatings of other manufacturers will be considered only if equivalent systems of coatings can be provided and only if a record of satisfactory experience with the system in equivalent applications is available. Offers for substitutions will not be considered which decrease film thickness, solids by volume or the number of coats to be applied, or which propose a change from the generic type of coating specified herein. All substitutions shall include complete test reports to prove compliance with specified performance criteria.

Part 3 – Execution

Preparation

Take any measures necessary to prevent over-spray of structures and/or components in the field from both preparation and coating work. Should over-spray occur, the Contractor is responsible for all costs associated with any damage resulting from over-spray.

Installers

Contractor is responsible for quality assurance including the retention of a coating applicator with experience necessary to complete the work as specified. Applicator's personnel shall be adequately trained for application of specified coatings. Applicator must prove adequate experience with the coatings specified for this project.

Examination

The Owner shall inspect and approve all surface preparations prior to application of any coating. Provide 24-hour notice prior to surface inspection needs.

Preparation

Prepare surfaces in accordance with the recommendations of the manufacturer of the coating to be applied to the surface, or the surface preparation requirements of these specifications, whichever are stricter. In general, all surface preparation shall meet Structural Steel Painting Council (SSPC) Surfacing Preparation (SP) guidelines, the National Association of Pipe Fitters (NAPF), American Water Works Association (AWWA) and/or the National Association of Corrosion Engineers (NACE) as noted herein unless more strictly described by coating manufacturer.

Apply coatings only during weather meeting the coating manufacturer's recommendations. Air and surface temperatures, humidity, and all other environmental conditions shall be within

limits prescribed by the manufacturer for the coating being applied, and work areas shall be reasonably free of airborne dust at the time of application and while coating is drying.

Materials shall be mixed, thinned, and applied according to the manufacturer's printed instructions. Dry Film Thickness (DFT) shall be as stated herein or applied based on coverage rates of square feet per gallon (sq. ft./gal).

Installation/Construction

Apply paint in strict accordance with manufacturer's printed instructions except that coating thickness specified herein shall govern. Finished coating on all items shall be clean, undamaged, and of uniform thickness and color.

Coat in a manner satisfactory to the Owner. The DFT listed in these specifications must be met, regardless of the applied film thickness or number of coats.

Observe all safety precautions stated in the manufacturer's printed instructions. Provide adequate ventilation and lighting at all times.

The manufacturer's recommended drying time shall be construed to mean "under normal conditions". Where conditions are other than normal because of weather, confined spaces, or other reason, longer drying times may be necessary. The manufacturer's recommendation for recoating time intervals shall be strictly adhered to.

Pipe being coated shall be emptied of water for a minimum of 24 hours prior to surface preparation and painting. Pipe shall not be filled with water until coating is dry. If, in the Owner's opinion it is not practical to drain the pipe, the water must stand for at least 48 hours to reach ambient temperature prior to coating the pipe. Do not allow water to flow for at least 24 hours after each coat.

Field Quality Control

The prime Contractor shall be completely responsible for coating quality. The Contractor shall provide both wet and dry film gauges and make such available to the Owner when requested.

If coating inspector finds anomalies and/or defects, the Contractor shall re-prep and recoat those areas per the coating manufacturer's instructions.

Acceptance of the completed coatings shall be based on the proper application and proper preparation of the coated surfaces, and a finished product that meets minimum thickness and does not contain runs, drips, surface irregularities, overspray, color variations, scratches, pinholes, holidays, and other surface signs that detract from the overall performance and/or appearance of the finished project.

If, in the Owner's sole opinion, the finished color does not match that of the submitted and approved colors, the Contractor will recoat as necessary to achieve the approved color at no additional cost to the Owner.

Inspection

For metals exposed to exterior atmospheric conditions, first coat of paint or primer must be placed within four hours of passing inspection. Bare steel must be reblasted and reinspected if not successfully coated within this four-hour time frame, at the Contractor's expense.

Use the Pictorial Surface Preparation Standards for Painting Steel Surfaces (VIS-1) by the Steel Structures Painting Council (SSPC) as a visual standard for inspection of surface preparation of metal surfaces. Test-Tex Tape may also be used to verify surface profile.

Inspect each coat prior to application of the next coat. Areas found to contain runs, overspray, roughness, streaks, laps, sags, or other signs of improper application shall be repaired or recoated in accordance with the manufacturer's recommendations. Finish coats shall be uniform in color and sheen. Surface preparations and coatings not inspected and approved by the Owner will be uncovered for inspection and approval at no additional cost to the Owner.

Repair/Restoration

The Contractor is responsible for all costs associated with any damage that occurs as a result of over-spray.

Scratched, chipped, or otherwise damaged coatings, including factory coatings, shall be repaired before final acceptance will be given.

Cleaning

If any cleaning of equipment at the site is performed with solvents, such work shall be done over leak-proof linings. Preparation or coating materials may not be disposed of onsite.

9.90.06 Product and Color Schedule

[CSI 09 06 90 or 09 90 06]

Colors of finish coatings on process equipment, piping, and building surfaces shall conform to the following schedule. All finishes shall be satin unless otherwise specified. Finish coatings, which are applied in the shop by the manufacturer, shall conform to this section. Factory coatings which are damaged shall be recoated in the field in accordance with these specifications.

Items of similar purpose shall be painted the same color. If items come from the factory with a shop applied coating that does not match said color, they shall be field coated to match. Exceptions may be listed in individual sections of these specifications.

The contractor shall allow no less than 15 working days from the time the Owner is provided with color selections for the Owner to make color choices.

The Owner will develop a color schedule for painted items after award of the contract. Provide a pallet of colors from the manufacturer of not less than 30 color choices.

9.90.13 Unpainted Items

[CSI 09 90 13]

Part 1 – General

Summary

Do not coat the following items unless specifically directed otherwise in these specifications or on the Plans.

- Aluminum, plastic, or stainless-steel items.

- Brass and copper pipe, valves, and fittings for plumbing fixtures.
- Nameplates, labels, or identification tags.
- Sensors, switches, transmitters.

Field painting is not required for equipment listed below if they come with a factory finish epoxy, polyurethane, or powder coat. Items supplied with only a factory prime coat must be field coated.

- Motors
- Control valve pilot systems
- Sensor piping systems
- Valves
- Flow meters
- Electrical panels

9.91.13.13 - System 1: Ferrous Metal Pipe Exterior and Supports including Steel, Cast Iron, and Ductile Iron (Exposed Indoors).

[CSI 09 91 13 20]

Part 1 - General

This Section applies to all ductile/cast iron and ferrous metals, including bituminous coated pipe and materials unless specified otherwise. Do not coat stainless steel materials unless specified otherwise. This Section applies to all pipe materials and equipment, including manufacturer applied coating systems.

Part 2 - Products

1. Tnemec
    a. Primer: Series 1 Omnithane (2.5 to 3.5 Mil DFT).
    b. Intermediate Coat: Series N69 Hi-Build Epoxoline II (6 to 8 Mil DFT)
    c. Finish Coat: Series 73 or 1095 Endura-Shield (3 to 5 Mil DFT)
2. Sherwin Williams
    a. Primer: Corothane 1 Mio-Zinc Primer (2.5 to 3.5 Mil DFT)
    b. Intermediate: Macropoxy 646FC B58-600 Series (6 to 8 Mil DFT)
    c. Finish:
        i. Indoors: Acrolon Ultra B65-830 Series (2 to 3 Mil DFT)
3. International Devoe
    a. Primer:
        i. Fast Set Option: Devran 261QC Epoxy

ii. Cold Cure Option: BarRust 235 Epoxy

iii. Summer Option: BarRust 231 Epoxy Mastic (4 to 6 Mil DFT)

b. Intermediate Coat:

i. Fast Set Option: Devran 261QC EpoxY

ii. Cold Cure Option: BarRust 235 Epoxy

iii. Summer Option: BarRust 231 Epoxy Mastic (4 to 6 Mil DFT)

c. Finish Coat:

i. Fast Set Option: DevThane 349QC Aliphatic Polyurethane

ii. Commercial Option: DevThane 389 Aliphatic Polyurethane

iii. Premium Gloss Option: DevThane 379 UVA Aliphatic Polyurethane

iv. Premium SemiGloss Gloss Option: DevThane 378 UVA Aliphatic Polyurethane. (2 to 3 Mil DFT)

Part 3 - Execution

Preparation

1. To prevent surface condensation, whenever possible the pipe should be empty and allowed to reach ambient temperature before coating. If condensation is present, dry thoroughly prior to coating.
2. Ferrous Metals
   a. SSPC-SP10 Near white blast cleaning
3. Ductile and Cast-Iron Materials
   a. It is strongly recommended that ductile iron and cast-iron pipe or materials to be field coated should be purchased factory primed without the standard asphalt coating. Field removal of asphalt coatings is extremely difficult and overly aggressive preparation can create a damaged surface unsuitable for coating.
   b. Remove all oils, grease, and other contaminants using solvent cleaning prior to abrasive blasting or power tool cleaning. Blemishes or staining on the prepared surface are acceptable if such items cannot be removed by light scraping with a knife. SSPC-SP10 blue-gray with surface profile of 2.0 Mil, minimum. Do not burnish the surface. Clean all surfaces of dust and loose residue immediately prior to coating. See NAPF 500-03-04/05.
4. Prepare and coat all exposed bolt heads, threads, washers, nuts, and tie rods with the same system as the pipe.

9.91.33.01 - System 2: Metals in Contact with Drinking Water (DI pipe interior if not mortar and asphaltic lined, Steel pipe interior)

[CSI 09 91 33 13]

Part 1 – General

Summary

This section applies to metals in contact with potable drinking water.

References

Coatings shall be NSF 61 approved for use in direct contact with potable drinking water. The NSF 61 approval shall be appropriate for the application at the time of submittal. Contractor is responsible for verifying the current NSF 61 requirements and restrictions of submitted coating.

Part 2 – Products

Materials

1. Tnemec
    a. Valves ≥ 1½-inch diameter; Pipe ≥ 6-inch diameter; Tanks ≥ 25 gallons.
        i. Primer: None
        ii. Finish Coat: Series FC22 Epoxoline (16 to 20 Mil DFT)
    b. Fittings, Valves, & Pumps ≥ ½-inch diameter; Pipe ≥ 10-inch diameter; Tanks ≥ 50 gallons.
        i. Primer: None
        ii. Finish Coat: Series 22 or FC22 Epoxoline (either one coat at 16 to 20 Mil DFT or two coats at 12 to 16 Mil DFT each coat)
    c. Fittings, Valves, & Pumps ≥4-inch diameter; Pipe ≥18-inch diameter; Tanks ≥ 1,000 gallons.
        i. Primer: Series N140 Pota-Pox Plus or Series 141 Potapox 80 (6 to 8 Mil DFT)
        ii. Finish Coat: Series N140 Pota-Pox Plus or Series 141 Potapox 80 (6 to 8 Mil DFT)
2. Sherwin Williams (Pipes ≥6-inch diameter; Tanks ≥100 gallons)
    a. Primer: None
    b. Finish Coat: Sherplate PW (16 to 20 Mil DFT)

3. International Devoe (Pipes ≥18-inch diameter; Valves ≥3/4-inch diameter; Tanks ≥ 300 gallons)
    a. Primer: BarRust 233H (6 to 8 Mil DFT)
    b. Finish Coat: BarRust 233H (6 to 8 Mil DFT)

Part 3 – Execution

Surface Preparation

Ferrous Metal – SSPC SP1 followed by SP10 Near White Blast. Surface profile shall be 2.0 Mil, minimum.

Ductile Iron – SSPC SP1 followed by NAPF 500-03-04/05 Grey White Blast or SP10 Grey White Blast. Surface profile shall be 2.0 Mil, minimum.

Division 11
Equipment

11.00 GENERAL

Sections in these specifications titled "*Common Work for . . .*" apply to all following subsections whether directly referenced or not.

11.05 Common Work for Equipment

[CSI 11 05 00]

Part 1 - General

Related Sections

- Division 1.81.30 Seismic Restraint Requirements

Submittals

Provide submittal information to the Owner for the following items:

- Pumps and Motors
- Pump Anchor Bolts

11.10 PUMPS

[CSI 43 20 00]

11.10.05 Common Work for Pumps

[CSI 43 20 05]

Part 1 - General

Summary

This section covers work necessary to provide the pumps, complete with motors and accessories, described herein and as shown on the Plans.

Related Sections

- Division 1.75 Starting and Adjusting
- Division 1.81.40 Pressure Ratings
- Division 1.81.50 Materials in Contact with Drinking Water
- Division 9.91.13.13 Coatings – Exposed Ferrous Metals, Indoors
- Division 9.91.33.01 Coatings, Metals in Contact with Drinking Water
- Division 11.19 Pump Anchor Bolts
- Division 11.20.1 Common Work for Pump Motors

References

- HI - Hydraulic Institute.
- ASTM - American Society for Testing and Materials.
- AISI - American Iron and Steel Institute.
- ANSI - American National Standards Institute.

Definitions

Pumps are classified by the following terms:

Centrifugal – Single or multi-stage impellor pumps, not of the turbine category. Examples are End Suction, Split Case, Double Split Case, and Vertical Multistage.

Performance Requirements

Power required to operate the pump(s) shall not exceed the motor nameplate horsepower regardless of any flow and head tolerances listed in this specification, unless allowed otherwise in the Pump Motors section.

The design and performance requirements listed for each pump must be met, with no exceptions. Pumps that do not meet all of the conditions will be rejected.

The design point efficiency must be as follows:

Type	Specific Speed (Hz)	Efficiency
Centrifugal	45	48%
Centrifugal	60	78%

Pump parts in contact with potable water, or raw water being supplied to a potable water treatment facility, shall be lead free complying with either NSF 61 ANSI 372 tested or NSF 61 Annex G compliant. Submit lead free information with pump submittal information.

Pump Name or No.	**1, 2 and 3**
Type	Vertically Mounted Centrifugal
Maximum Speed	3,600 rpm
Max Design Head	250 ft
Max Design Flow	350 gpm
Min Design Head	240 ft
Min Design Flow	100 gpm
Min. Shutoff Head	120 ft
Max. Shutoff Head	430 ft
Performance Requirements at Design Point	
Min. Pump Efficiency	78.0% (at Max Design Flow)
BEP Position	Right of Design Point
Tolerance Grade at Design Point	1U
Max. NPSHR	17 ft at 350 gpm
Fluid	Potable Water
Max. Fluid Temperature	68 degrees F

Head Conditions

Head conditions specified in the table are inclusive of all pump components including the casing/bowls, discharge head or elbow, column pipe, and intake strainer, as applicable.

Tolerance Grade

Performance range shall adhere to the HI 14.6 (centrifugal and vertical pumps) tolerances stated herein are referenced at the specified design point(s). Flow tolerance is measured at the design point head. Head tolerance is measured at the design point flow. Efficiency is evaluated where a straight line drawn from zero flow, zero head, passes through the design point and crosses the actual pump curve.

All tolerance requirements listed must be met. They are not independently exclusive.

Grade 1U (0% to +10% Flow, and 0% to +6% Head, and no less than 0% Efficiency).

Design Requirements

For pumps with column pipe (vertical turbine, submersible well, etc.) size the column pipe to meet the criteria below. Calculate velocity including the reduction of flow area from the shaft. Provide calculations with the submittals.

Submittals

Provide the following information:

Source Quality Control

- A minimum of 3 installations with similarly sized and configured pumps in equivalent fluid applications installed by the Contractor or installer subcontractor. Include location, contact name, and number.
- Company name, address, and phone of the closest manufacturer's authorized service company and a qualified service company. Qualified service may be a company that is not a manufacturer's authorized service center but can perform competent service and order repair and replacement parts. Authorized service must within the 48 contiguous US states. Qualified service must be within 300 miles of the project site.

Product Data:

- Specifications and data describing all pump parts, pieces, and components. Include information on materials of construction and proposed coating systems.
- Performance curves showing total dynamic head (TDH) in feet, efficiency, and net-positive-suction head required (NPSHR) versus output in gallons per minute (gpm). All losses from the drive shaft, seal, coupling, and other mechanical losses shall be included in the data presented. Catalog or software generated curves may be submitted for preliminary approval and ordering.
- Additional VFD pump curves for speeds at 80 percent and 90 percent of full speed.
- Documentation on assembled pump and motor unit natural frequency. Natural frequency shall not occur within 20 percent of speed above or below the pump's operating speed range of 2,700 rpm to 3,600 rpm.
- Provide up and down thrust forces versus flowrate for each design point specified.
- Provide up thrust force at dry start condition.
- Complete list of all pump system components and accessories.
- Column pipe headloss calculation (if applicable).
- Bearing life (L10) for ball and roller bearings. Calculations supporting L10 of no less than 40,000 hours.

Shop Drawings:

- Detailed dimensional drawings showing outline dimensions, lengths, overall sizes, materials, and weights for each pump unit and associated accessories.

Closeout Submittals: Provide the following submittals prior to project closeout:

- Operations and Maintenance manual.
- Manufacturer signed warranties with pump serial numbers.

Schedule

Provide delivery time in time from approval of shop drawings/submittal. All equipment shall be delivered within 12 weeks or less from approval of complete submittal information.

Quality Assurance

The pump manufacturer is responsible for the motor and pump assembly.

Delivery, Storage, and Handling

Deliver, store, and handle pumps in accordance with manufacturer's recommendations.

Warranty

Warrant all pumping equipment described in this section and provided under this contract against defects in materials and workmanship for a period of two years after date of project acceptance.

Following pump and motor installation, furnish the services of a qualified manufacturer's representative to inspect pump units and inform Owner, prior to field testing, of any defects or concerns regarding condition of each unit and its installation at the job site. Upon resolution of any defects or concerns (if any) and work performed by the Contractor at their expense, to the satisfaction of the Owner, manufacturer's warranty shall then be in full effect with no reservation or qualifications other than those stated in the manufacturer's warranty. Upon completion of pump installation, manufacturer's representative shall provide written certification that equipment is fully warranted as installed.

Extra Materials

Provide any special tools required for pump or motor maintenance.

Part 2 - Products

Existing Products

The supplied pump(s) shall fit into the space of the existing pump(s) being replaced. Verify dimensions in the field for pump installation. If modifications to any equipment or new adapters are necessary to accept the new pump, provide all required modifications, fittings and adapters, and include the price in the bid. Additional reimbursement for modifications will be paid by time and materials only if, in the opinion of the Engineer, actual conditions vary materially from those presented in these contract documents and were not reasonably determinable from a pre-bid field inspection.

Existing components may be reused only if specifically identified below. Existing wear components (e.g. bearings, shaft, seals, gaskets, etc.) may not be reused and shall be removed and replaced. Reused components shall be cleaned and recoated per Division 9.

- Mounting structure (base plate or skid)

Manufacturers

The following manufacturers are pre-approved for use on this project. The bidder may submit another brand for review prior to the bid. Follow the procedures under Division 1.25.13.10 Substitutions Prior to Bid Opening. Accepted brands will be approved through addendum. No substitutions for different pump brands will be accepted after the bid.

Centrifugal (Vertical Mount)

Grundfos	Goulds ITT
Crane Weinman	Xylem Goulds

Components

For pumps in domestic water applications, all wetted pump components, coatings, and lubricants shall be approved for use in potable drinking water in accordance with U.S. Food and Drug Administration (FDA) or National Sanitation Federation (NSF 61) rules and regulations.

Neither 201 nor alloy-20 stainless steels are approved for any pump components unless specifically mentioned otherwise in these specifications.

All pump system components are to come from the pump manufacturer and include:

- Motor
- Discharge head, elbow, or pump casing
- Couplings
- All other necessary appurtenances for complete unit assembly.

Accessories

Provide removable guards to protect personnel from rotating components. Guards to meet the minimum requirements of WAC 296-806-20042.

All pumps are to include an engraved non-corrodible metal nameplate on the exterior of the pump head or body (duplicate attached to pump support flange or shipped loose if submersible), readily accessible without requiring any disassembly. The nameplate shall include, at a minimum, the following information (as applicable for the type of pump):

- Pump Manufacturer
- Pump Model Number
- Pump Serial Number
- Impeller Number
- Impeller Trim
- Number of Stages
- Design TDH (feet)
- Design Flow (gpm)
- Supplier Name and Phone Number
- Date of Manufacture

Source Quality Control

Graphs must be submitted and approved prior to shipment of pumps.

Part 3 – Execution

Preparation

Disinfect domestic water pumps by flushing with a solution of 50 ppm chlorine prior to installation. After disinfecting, immediately flush and rinse the pumps with clean water to remove the high chlorine concentration solution. This includes the impellers and interior of bowls and casings.

Installation/Construction

Install pumps in accordance with manufacturer's directions. Installation shall be supervised and approved by manufacturer's representative prior to operating or field testing.

Adjust pump assemblies so that driving units are properly aligned, plumb, and level with the driven units and all interconnecting shafts and couplings. Flexible couplings shall not be used to compensate for misalignment.

Connect piping to the pump in a manner which prevents strain on the pump casing or head.

Field Quality Control

See Division 1.75 Starting and Adjusting for scheduling and notification requirements.

A qualified and authorized representative of the pump manufacturer shall conduct or supervise the field testing. Prior to acceptance of installed pumps, manufacturer's representative shall demonstrate proper operation of pumps at capacities stated.

Contractor is responsible for startup and adjustments to meet the specifications. Perform field tests to represent the performance of the new pump(s) when operating under actual field conditions and to establish the acceptance of the pump(s) furnished and installed. Perform the field test in the presence of the Owner after the piping and controls have been installed.

Perform a performance test similar to those described in the latest edition of Hydraulic Institute's (HI) Pump Tests (ANSI/HI 14.6 centrifugal and vertical, ANSI/HI 11.6 Submersible), with results for each pump submitted to the Owner for approval.

Perform a field test to the accuracy obtainable with the monitoring equipment installed with the piping and instrumentation. If sufficient field devices are not available to test all parameters, the Contractor shall provide testing gauges and meters as needed. At a minimum, the following are needed:

- Electric current and voltage meter(s), one per phase.
- Vibration sensor.

Where existing gauges and meters are retained and not been replaced under this contract, the Contractor may temporarily replace such equipment during testing with their own at their expense, if approved by the Owner. The Owner makes no guarantee of the accuracy of existing gauges and meters.

Results shall be within plus or minus 1 percent of the tolerances listed above under Performance Requirements.

Perform testing under the observation of the Owner. At that time, the following data shall be collected for each pump:

- TDH vs. Flow at a minimum of three points which include: Shutoff head (unless pressure is deemed excessive by the Owner), fully open to system, and approximately 50 percent design flow with throttled discharge valve. Additional points may be required at the discretion of the Owner.
- Overall Efficiency (motor power draw required for this calculation).
- Take vibration readings under normal operating conditions at the design point. If it is not possible to reach the exact design point, then the vibration readings will be taken within the preferred operating range at a point agreed to by the Owner. A factory vibration test is not a substitute for a field test.
- If a throttled valve is used to adjust the operational point during vibration testing, the valve must be no closer than 20 times the pipe diameter from the pump and separated from the pump by at least one flexible pipe joint.
- For variable speed pumps, take readings at full speed and two reduced speeds as directed by the Owner. Do not test below 75-percent of design flow without Owner's approval.
- Read vibrations at the locations described in HI 9.6.4.2.3. In general, the reading locations shall be at:
- The middle of each bearing housing of between bearing pumps.
- Near the outer casing bearing of end suction pumps.
- Near the top of the motor support flange for vertical motors.
- Read vibrations in the three orthogonal planes, with the maximum reading governing the results. If the vibration tests fail, the pump manufacturer and/or Contractor shall modify the equipment and/or installation and retest until the standards are met. Submit the vibration test results to the Owner. The manufacturer's representative shall provide proper, calibrated instrumentation to verify completed unit vibration.
- Field vibration testing shall be performed by a Level 1 certified Vibration Analysis Tester. Certification shall be current and from one of the following: Mobius Institute, Vibration Institute, Technical Associates of Charlotte.

Maximum allowable completed unit vibration (pump and motor installed) as shown below. (Velocity measurements are inch/second RMS).

Between Bearing and End Suction	
Power	Vibration
(hp)	(in/sec)
0-267	0.15

Upon completion of pump installation and testing, manufacturer's representative shall provide written certification that equipment is installed correctly and fully warranted. Provide certification that pumps meet all requirements set forth in these specifications and submittal literature. The Contractor shall provide a written report of all test conditions and results.

Repair

Repair and retest units failing any field test. If unit fails second field test, unit will be rejected, and supplier shall furnish a unit that will perform as specified.

11.11.30 Vertical Centrifugal

[CSI 43 23 31.29]

Part 1 - General

Design Requirements

The pumps shall be a vertical centrifugal design equal to **Grundfos CR 64-3 with 40 HP motor** as represented by **Pumptech, Bellevue, WA**. Each **pump and motor shall be capable of 10 starts per hour** with statement provided as such with the pump submittal and warranty.

All pumps supplied for the project shall come from one manufacturer.

Related Sections

- Division 11.10.05 Common Work for Pumps
- Division 1.81.40 Pressure Ratings

Part 2 – Products

Components

Vertical Centrifugal Pumps shall have the following features:

1. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.
2. The suction/discharge base shall have ANSI Class 125 flange.
3. Pump construction
    a. Suction/discharge base, pump head, motor stool: Cast iron (A 48-30 B).
    b. Impellers, diffuser chambers, outer sleeve: Stainless Steel 304.
    c. Shaft Steel: Stainless steel 304
    d. Impeller wear rings: Stainless Steel 304
    e. Shaft journals and chamber bearings: Silicon Carbide
    f. O-rings: EPDM

4. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling, and motor. The entire cartridge shaft seal shall be removable as a one-piece component.

11.19 Pump Anchor Bolts

[CSI 03 15 19 (cast-in) or 05 05 19 (drilled)]

Part 2 - Products

Materials

Pump anchor bolts to be epoxy anchors equal to Hilti HIT-RE 500-SD or Simpson Strong Tie SET-XP using 316 stainless steel threaded rod. Rod diameter to be the largest that will fit in the pre-drilled pump mounting base, unless approved otherwise by the Engineer.

Rod Diameter	⅜-inch	½-inch	⅝-inch	¾-inch
Minimum Embedment	3.5-inch	4.25-inch	5-inch	6.625-inch
Minimum Edge Distance	5.25-inch	6.5-inch	7.5-inch	10-inch

Pump manufacturer or authorized representative shall verify size and supply the pump anchor bolts and check installation.

11.20 PUMP MOTORS

11.20.01 Common Work for Pump Motors

[CSI 40 05 93]

Part 1 - General

Summary

This section is not applicable for chemical dosing pumps or small sump pumps.

Related Sections

- Division 9.91.13.1 Coatings – Exposed Metals, Indoors
- Division 11.10.05 Common Work for Pumps

References

- HI - Hydraulic Institute.
- ASTM - American Society for Testing and Materials.
- AISI - American Iron and Steel Institute.
- ANSI - American National Standards Institute.
- IEEE – Institute of Electrical and Electronics Engineers

Submittals

Submittal information shall be provided for each individual motor.

Complete list of all motor components and accessories to be provided. All motor system components are to come from the pump manufacturer.

Company name, address, and phone of the closest manufacturer's authorized service company and a qualified service company. Qualified service may be a company that is not a manufacturer's authorized service center but can perform competent service and order repair and replacement parts. Authorized service must within the 48 contiguous US states. Qualified service must be within 250 miles of the project site.

Specifications and data describing all motor parts, pieces, and components. Include information on materials of construction and proposed coating systems.

Motor data including type, torque, RPM, no-load current, full-load amps, service factor, power factor, and motor efficiency at full-load. Provide maximum recommended motor starts per hour.

For variable speed drive motors, provide performance curves and motor efficiency at 80, 90 and 100-percent of full load.

Bearing life (L10) for ball and roller bearings. Calculations supporting L10 of no less than 40,000 hours.

Provide catalog data for each motor showing the following information:

- Horsepower vs. Load
- Power factor vs. Load

Shop Drawings:

- Detailed dimensional drawings showing outline dimensions, lengths, overall sizes, materials, and weights for each motor and accessories.
- Wiring diagrams for motor and any embedded sensors or switches.

Closeout Submittals: Provide the following submittals prior to project closeout:

- Operations and Maintenance Manual
- Manufacturer signed warranties with serial numbers.

Quality Assurance

Motors shall be dynamically balanced at the factory and shall have rigid mounting maximum vibration amplitude meeting NEMA MG-1 Grade A:

	Grade A
Maximum Vibration	0.0019 inch pk-pk 0.12 inch / sec
3,600 rpm	All sizes

Delivery, Storage, and Handling

Deliver, store, and handle motors in accordance with manufacturer recommendations. Store in a dry, enclosed environment and in the same orientation as their final mounting.

Design Requirements

- Motors designed for continuous cycle.
- Full compliance with NEMA MG-1. Squirrel cage induction type. Vacuum impregnated windings.

Motors to be premium efficiency with efficiency at design point not less than shown in Table C405.8(1) or C405.8(2), as applicable, of the Washington State Energy Code (WAC 51-11C-40508), current edition. Efficiency as determined by IEEE Standard 112, Test Method B.

Size motors such that power draw in the defined operating range of the pump shall not exceed the nameplate size. Power draw shall not encroach into the service factor. Motor size selection shall include all losses, including motor and pump bearings.

Reverse thrust bearings: Oil-bath lubricated with up-thrust (or reverse axial thrust) protection of 30 percent of the normal operating thrust, or as required to support the pump reverse thrust at dry startup, whichever is less.

Pump Name or No.	1, 2 and 3
Phase, Volts, Hz	3-ph, 480-V, 60-Hz
Horsepower (max. nameplate)	40
Starting (full voltage, reduced voltage, VFD) [1]	As shown
Nominal maximum speed (rpm)	3,600
Inverter duty (yes/no) [2]	Yes
Steady bushing required (yes/no) [3]	Yes
Reverse ratchet (yes/no) [4]	Yes
Enclosure [5]	ODP
NEMA Design [6]	B
Service Factor	1.15
Max ambient temperature rating	40° Celsius
Insulation	Class F (115° Celsius rise max.)
Actual field temperature rise	Class B (90° Celsius max.)
Anti-Condensation heaters (yes/no) [7]	No
Winding temperature sensors (PTC/RTD/None) [8]	None
Winding thermostats (yes/no) [9]	No
Bearing temperature sensors (yes/no)	No
Fluid leakage sensor (yes/no)	No

Table Footnotes

1. Full or reduced voltage starting: If not listed here, then as shown on the plans.
2. Motors for use with Variable Frequency Drives shall be inverter duty rated per NEMA MG1 Part 31.
3. Steady bushing (vertical motors): Must be provided when using a hollow shaft and mechanical seal. Also required for motors larger than 10 hp at speeds above 2,500 rpm.
4. Reverse ratchets: drop-in ball type (not pin and spring) non-reverse mechanism.
5. For motors larger than 500 hp that include flywheels, provide RPM vs Torque curve, RPM vs Current curve, and acceleration time for entire connected load inertia.

Warranty

All equipment described in this section and provided under this contract shall be warranted against defects in materials and workmanship for a period of two years after date of project acceptance.

Following motor installation, furnish services of a qualified manufacturer's representative to inspect units and inform Owner, prior to field testing, of any defects or concerns regarding condition of each unit and its installation at the job site. Upon resolution of any defects or concerns (if any) and work performed by the Contractor at their expense, manufacturer's warranty shall then be in full effect with no reservation or qualifications other than those stated in the manufacturer's warranty.

Upon completion of motor installation, manufacturer's authorized representative shall provide written certification that equipment is fully warranted as installed. A combined pump-motor warranty will be acceptable in lieu of separate warranties.

Maintenance

Provide any special tools required for motor maintenance. Provide enough lubricant for one service change.

Part 2 - Products

Accessories

All motors are to include an engraved non-corrosive metal nameplate on the exterior of the motor (duplicate shipped separately if submersible), readily accessible without requiring any disassembly. The nameplate shall include, at a minimum, the following information. Common abbreviations shown in brackets [ ].

- Manufacturer's name
- Motor type [TYPE]
- Model Number [MN, MODEL, MOD.NO]
- Serial Number [SN, SERIAL, SER NO]
- Frame size [FRAME]

- NEMA design letter [DESIGN]
- Insulation class or rated temperature rise [INS, CLASS]
- Nominal Power (hp) [HP, OUTPUT]
- Time rating [RATING]
- Locked rotor kVA code [CODE]
- Service Factor [SF]
- Voltage [VOLTS]
- Phase [PH]
- Frequency (Hz) [CYCLES]
- Full load amps [FLA]
- Full load speed (rpm) [SPEED, FL RPM]
- Nominal Efficiency (%) [NEMA NOM EFF]
- Date of Manufacture
- Special ratings (Inverter duty, NFPA, Class 1 Division 1, UL, etc.)
- Thermal protection (if sensors or switches are included)
- Minimum efficiency (%) [NEMA MIN. EFF]
- Enclosure type [ENCL]
- Number of poles [POLES]
- Weight (lbs)
- Bearing numbers / types
- Power factor [PF]
- Torque (ft lbs)

Connect motor and pump shaft with manufacturer's recommended coupling, complete with non-release protection (if non-reversing ratchet is not specified), to prevent pump shaft from unscrewing in the event of phase or flow reversal. Non-submersible motors heavier than 50 pounds shall have lifting lugs.

Finishes

Pump motors shall be furnished with a prime coat or finished epoxy coat of the manufacturer's standard finish. Stainless steel casings need not be coated. Motors with only a primer coating shall be finish coated in the field with a product suitable for the environment and the motor temperature range, submit to Owner for approval.

Part 3 - Execution

Examination

Provide all lifting equipment necessary for installation of the motors.

Installation/Construction

Install units in accordance with manufacturer's specifications and direction.

Field Quality Control

Installation shall be supervised and approved by manufacturer's representative prior to operating or field testing units. A field test shall be conducted and/or supervised by the pump or motor manufacturer's representative after the piping and controls have been installed. Upon completion of installation and testing, manufacturer's representative shall provide written certification that equipment is fully warranted installed.

Contractor is responsible for calibration, startup, and initial performance to meet specifications herein. A field test shall be made to give an indication of the performance of the new motor when it is operating under actual field conditions and to establish the acceptance of the motor furnished and installed. The field test shall be observed by the Engineer after the piping and controls have been installed. Testing shall be completed in accordance with the requirements provided above.

The Contractor shall provide calibrated and certified measuring devices to measure voltage, current, and power factor for each pump motor after they have been installed. The manufacturer's representative shall provide proper, calibrated instrumentation to verify maximum completed unit vibration amplitude.

The following data shall be collected for each motor:

- Motor current (amps), voltage, and power factor vs. Flow (gpm) at points specified by the Owner which may include shutoff head, throttled flow at 50-percent, and full flow.
- Vibration at design point.
- Vibration vs. Speed (variable speed motors only).

Repair and retest units failing field test. If unit fails second field test, unit will be rejected, and supplier shall furnish a unit that will perform as specified.

15.00 GENERAL

This division covers the work necessary for furnishing and installing mechanical appurtenances and accessories as described in these Specifications and shown on the Plans.

Sections in these specifications titled "*Common Work for . . .*" shall apply to all following subsections whether directly referenced or not.

15.05 Common Work for Mechanical

[CSI 33 05 00]

Part 1 - General

Summary

Provide the necessary piping, plumbing, fittings, and appurtenances to make all piping systems complete, tested, and ready for operation as specified herein and as shown on the Plans. Some fittings that are necessary for the complete piping system installation and operation may not have been shown. Provide fittings, pipe, and appurtenances necessary, whether shown on the Plans or not, to make all piping systems complete, tested, and ready for operation.

Some pipe supports, thrust blocking, and tie rods are not shown on the Plans. Provide pipe supports, thrust blocking, and tie rods for pipes as required by accepted design criteria to support and restrain the loads encountered.

Related Sections

- Division 1.81.40 Pressure Ratings
- Division 1.81.50 Materials in Contact with Drinking Water
- Division 10.14.23 Panel Signage

References

All products in contact with drinking water to be low-lead (less than 0.25 percent) content in compliance with NSF/ANSI 372.

Submittals

Submittal information shall be provided to the Owner for the following items:

- Ductile iron pipe
- Ductile iron fittings
- Steel pipe and fittings
- Vibration isolation fittings
- Copper pipe and fittings
- Brass fittings

- Isolation valves
- Control valves
- Flow meters
- Pressure gauges
- Other mechanical components listed in this division or required by the Engineer

Part 2 – Products

Existing Products

Existing pipe and fittings in contact with drinking water that are not compliant with low lead standard NSF/ANSI 372 (generally those installed before 2014) and will be modified under this contract must be upgraded to meet this standard. Existing pipe and fittings that will be reused, but not modified, do not require upgrading.

Materials

All valves, meters, hydrants, specialties, appurtenances, and other such mechanical and plumbing components that are of similar purpose shall be of a single manufacturer and model line. Do not "mix and match" unless specifically stated otherwise or allowed by the Engineer. The intention of this requirement is to maintain consistency across all components installed on the project for function, maintenance, aesthetics, and details of installation.

The following products shall be procured and provided with process instrumentation by the Control System Integrator, preselected by the Owner under subcontract with the Contractor:

1. **10-inch Magnetic flow meter and remote transmitter**
2. **Discharge pressure transmitter**
3. **Discharge pressure gauge**
4. **Pump discharge pressure gauge (3 quantity)**
5. **Pneumatic pressure tank pressure gauge**

Installation and field termination shall be completed by the Contractor (or subcontractor).

See Division 16 and 17 for additional goods and services to be provided by Control System Integrator, preselected by the Owner

Part 3 - Execution

Field Quality Control

Pressure gauges used for testing and commissioning shall be in good working order and scaled appropriately for the test. Scale range shall not exceed 200% of the test pressure. For example, for a 250 psi test, the gauge scale shall not exceed 500 psi. The Owner has the right to reject any gauges that are suspect in their accuracy.

If any components that have been approved by the Owner are not rated for the specified system test pressure, remove or isolate those components during pressure testing in a method acceptable to the Owner. Said components must still be pressure tested in their permanent configuration at their individual test pressure rating.

Cleaning

Potable Water Systems

After preliminary purging of the system, chlorinate entire potable water system in accordance with AWWA C651 for flushing and disinfecting water mains, and in accordance with all other pertinent rules and regulations. Operate each valve during chlorination period to provide contact. Retention time shall be 24 hours minimum, or 48 hours if the water temperature is less than 41° F. Total retention time shall not exceed 3 days after which the chlorinated water shall be immediately flushed out.

Upon completion of disinfection, thoroughly flush the entire potable water system at a velocity of 3 feet per second, allowing four complete exchanges of contents. Do not discharge chlorinated material to storm or surface water systems without thoroughly neutralizing the chlorine residual remaining in the water in accordance with AWWA C655 for field dechlorination.

For pipe and fittings that cannot be disinfected as described above, such as those used for final connections to live systems, swab with 200 ppm chlorine solution or immerse in a 50 ppm chlorine solution.

After final flushing and before the water pipe is connected to or placed in service, the Contractor shall request that the Owner arrange to have samples collected for bacteriological testing. At least one sample will be collected from each branch of the pipe. A copy of the test results shall be delivered to the Contractor for review. The Contractor shall not connect the water pipe to the existing distribution system prior to acceptance of the bacteriological test by the Engineer.

The Owner will pay the laboratory fee for the initial bacteriological test. The Contractor will pay for future testing if the initial test results are unsatisfactory.

15.20 PIPE AND FITTINGS

15.21 Common Work for Pipe and Fittings

[CSI 33 05 00 or 40 05]

Part 2 - Products

Components

Under no circumstance shall the fasteners be of lesser strength or higher corrosive potential than the materials being connected. If dissimilar metals are adjacent (for example: stainless steel flange connecting to ductile iron flange) a dielectric insulation kit shall be used.

Fasteners for pipe and fittings: Per AWWA standards unless otherwise specified. All relevant subsections of AWWA C100, C200, and C500. All bolts and studs shall be long enough so

that no less than two threads extend beyond the face of the nut. Non-submerged flange bolts to be ASTM A307 Grade A, zinc plated.

Finishes

For conditions other than submerged, all nuts and bolts shall be zinc plated, and suitable for above and below grade locations as required. Where above grade/exposed piping is specially coated, the connecting nuts and bolts shall be coated using the same system unless directed otherwise by the Owner.

Part 3 - Execution

Construction

All piping and related equipment to be joined shall be connected as shown on the Plans, specifications, as recommended by the manufacturer or as required by standard industry practices if not otherwise specified.

Steel and stainless steel threads shall be protected against galling using steel thread sealing tape equal to Cobas steel thread sealing tape. Tape shall be specific to the steel type used.

15.21.02 Shackle (Threaded Rod) Restraints

[CSI 33 05 09.33]

Part 1 - General

Definitions

Anchor fastener: The item which connects to the fitting and which the shackle rod passes through. Such as a 90° eye bolt or shackle plate.

Weathering steel: Steel alloy designed to resist corrosion. Often referred to using the genericized trade name Cor-Ten.

Design Criteria

Unless shown otherwise on the plans, use the following shackle rod sizes for 250 psi test pressure.

Pipe Size	Minimum Number (#) and Diameter of Rods		
	Undocumented steel or SS (30 ksi minimum yield)	SS cold drawn (35 ksi minimum yield)	Weathering Steel (45 ksi minimum yield)
4”	(2) at ½”	(2) at ½”	(2) at ½”
6”	(2) at ¾”	(2) at ¾”	(2) at ¾”
8”	(3) at ¾” or (2) at 1”	(3) at ¾” or (2) at 1”	(2) at ¾” or (2) at 1”
10”	(5) at ¾” or (3) at 1”	(4) at ¾” or (2) at 1”	(3) at ¾” or (2) at 1”
12”	(7) at ¾” or (4) at 1”	(6) at ¾” or (3) at 1”	(4) at ¾” or (3) at 1”
Contact Engineer for other sizes or pressure.			

Submittals

Provide submittal for anchor fastener which includes strength rating in pounds. For shackle plates, include dimensional drawing.

For high strength rods (cold drawn or weathering steel), provide submittals showing rod material and yield strength.

Part 2 - Products

Components

Anchor fasteners must be a steel alloy. Ductile iron, cast iron, or any material deemed brittle in the opinion of the Owner are not allowed.

Verify anchor fastener is appropriate for anchor location.

All buried shackled thrust restraint systems shall be stainless steel or weathering steel. Exposed shackles, such as in a vault or mechanical room, may be non-weathering steel but if so, must be coated with epoxy paint system. Clean rust prior to painting.

Material (* = weathering steel)	Yield Strength	Corrosion Resistant
Type 304/316 SS	Low (30 ksi)	Yes
ASTM A36	Low (36 ksi)	No
ASTM A588 *	Med (45 ksi)	Yes
ASTM A709 GR 50W *	Med (50 ksi)	Yes
ASTM A242 *	Med (50 ksi)	Yes
ASTM A307	High (60 ksi)	No
ASTM F3125 A325 Type 1	High (90 ksi)	No
ASTM F3125 A325 Type 3 *	High (90 ksi)	Yes

All components of any stainless steel or weathering steel system shall include only stainless steel or weathering steel components. Bolts, nuts, washers, rods, and other components shall be one material and not intermixed.

Shackle systems must provide a mechanism to prevent unthreading. Exposed shackles shall use double nuts. Buried shackle systems may use double nuts, single nut with tack weld, or single nut with center punch on outside rod thread.

Provide washers at anchor fasteners. Install anchor fasteners on the opposite side of the flange or mechanical joint from the rod.

Part 3 - Execution

Installation

For standard elongation restraint, space shackles roughly equally around the pipe.

When restraint is intended to allow deflection movement without expansion, such as at a pump or tank connection, concentrate rods along the neutral axis of deflection. In other words, if vertical deflection is allowed, place rods along horizontal axis. Confirm proper orientation with Owner.

Nuts shall be finger tightened to snug, then tightened by wrench one full turn. Do not overtighten.

Field Quality Control

For high strength rod, labels from packaging showing rod material must be given to the Owner in the field. If package labels are not available, Owner has the right to assume rods are not high strength and may require installation of additional rods and field coating.

15.22 Metal Pipe and Fittings

15.22.02 Ductile Iron Pipe and Fittings

[CSI 33 05 19 or 40 05 19]

Part 1 - General

Design Requirements

Ductile iron pipe shall have thickness designed in accordance with ANSI/AWWA C150/A21.50 and shall be based on laying conditions and internal pressures to meet the requirements of Division 1.81.40 unless listed as more stringent below.

The pipe thickness shall not be less than that of Class 200 pipe for non-flanged pipe.

The pipe thickness for fire hydrant runs shall not be less than Class 52.

Flanged joints shall conform to ANSI Standard B16.1 and be of the class shown on the plans.

Part 2 - Products

Manufactured Units

Pipe exterior shall be coated per Division 9.91.13.13. Pipe interior shall be cement-lined and asphaltic coated in accordance with ANSI Standard A21.4 (AWWA C104) unless otherwise specified and shall conform to ANSI Standard A21.51 (AWWA C151).

Rubber gasket pipe joints are to be push-on-joint (Tyton) or mechanical joint (MJ) in accordance with ANSI Standard A21.11 (AWWA C-111), unless otherwise specified.

When requested, furnish certification from the manufacturer of the pipe and gasket being supplied that inspection and all of the specified tests have been made, and the results comply with requirements of this standard.

Ductile Iron Fittings

All fittings shall be ductile iron where possible. Steel fittings will not be accepted where ductile iron is called out on the plans. Ductile iron fittings shall be short-body, cement-lined, and for the pressure rating noted in Division 1.81.40. Metal thickness and manufacturing processes shall conform to applicable portions of ANSI Standards A21.20, A21.11, B16.2, and B16.4.

Standard cement lining shall be in accordance with ANSI Standard A21.4 (AWWA C104).

Mechanical joint (MJ), ductile iron, compact fittings 3-inches through 24-inches, and 54- inches through 64-inches shall be in accordance with AWWA C153.

Flanged pipe spools shall be fabricated from minimum Class 53 wall thickness pipe and conform to ANSI/AWWA C115/A21.15 with the exception that flanges shall be fabricated from ductile iron unless otherwise specified in the Contract Documents. Interior shall be cement lined.

Ductile iron flange (FL) fittings shall be in accordance with AWWA C110 and fabricated from ductile iron unless otherwise specified in the Contract Documents with a bolt pattern to match adjacent pipe. Gasket material for flanges shall be Styrene Butadiene Rubber (SBR, Buna-S), neoprene, nitrile rubber (NBR, Buna-N), chlorinated butyl, or cloth-inserted rubber. Gaskets shall be full-face. Gaskets shall be a minimum ⅛-inch thick.

Type of ends shall be specified as mechanical joint (MJ), restrained joint (RJ), true restrained joint (TRJ), plain end (PE), or flanged (FL).

Finishes

For above grade and exposed pipes, including those inside structures, prepare surfaces and coat the exterior per Division 9.91.13.13.

Part 3 - Execution

Installation

Install ductile iron water mains in accordance with AWWA C600. Provide tools and equipment, including any special tools required for installing each type of pipe used.

The amount of deflection at each pipe joint shall not exceed 3-degrees per joint (11 inches over 18 feet), or the manufacturer's printed recommended deflections, whichever is less.

15.22.03 Steel Pipe and Fittings

[CSI 33 05 24.23 or 40 05 24.23]

Part 1 - General

References

Unless otherwise stated, the latest edition for any commercial standards and all manufacturing tolerances referenced therein shall apply.

- ANSI/AWS D1.1 Structural Welding Code- Steel
- ANSI/AWS B2.1 Specification for Welding Procedure and Performance Qualification
- ANSI/AWWA C200 Steel Water Pipe—6 In. (150 mm) and Larger
- ANSI/AWWA C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 In. (100 mm) and Larger- Shop Applied
- ANSI/AWWA C206 Field Welding of Steel Water Pipe

- ANSI/AWWA C207 Steel Pipe Flanges for Waterworks Service—Sizes 4 In. Through 144 In. (100 mm through 3,600 mm)
- ANSI/AWWA C208 Dimensions for Fabricated Steel Water Pipe Fittings
- ANSI/AWWA C209 Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipe
- ANSI/AWWA C210 Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
- ANSI/AWWA C214 Tape Coating Systems for the Exterior of Steel Water Pipelines
- ANSI/AWWA C215 Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines
- ANSI/AWWA C216 Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fitting
- ANSI/AWWA C218 Liquid Coating Systems for the Exterior of Aboveground Steel Water Pipelines and Fittings
- ANSI/AWWA C222 Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings
- ASME Section IX International Boiler & Pressure Vessel Code:

  Welding and Brazing Qualifications
- ANSI/ASME B36.10 Welded and Seamless Wrought Steel Pipe
- AWWA M11 Steel Water Pipe: A Guide for Design and Installation

Design Requirements

Pipe

Pipe thickness as necessary to meet the pressure requirements in Division 1.81.40, and as follows:

1. Buried piping shall have a minimum pipe thickness of 0.25-inches.
2. Aboveground piping shall be Standard Weight or greater Schedule as required for the pressure requirements.

Construct welded steel pipe in accordance with the ASME Welding Code and as shown in the Plans. Steel pieces shall be constructed as dimensioned to exact tolerances of ± 3/32-inch.

Construction steel pipe in accordance with AWWA C200. Steel pipe shall be fabricated from steel manufactured to meet the requirements of ASTM A53, Type E or S, minimum Grade B. Design stress shall be half the yield stress of the steel. All longitudinal and girth seams, whether straight or spiral, shall be butt-welded using an approved electric-fusion-weld process.

Buried piping shall be furnished principally in 50-feet net laying lengths with shorter lengths, field trim pieces and closure pieces as required by plan and profile for location of elbows, tees, reducers and other in-line fittings or as required for construction.

Where grooved joints are used, pipe thickness shall be modified accordingly to maintain the hydrostatic test pressure compliance.

Aboveground steel pipe and fittings 26 inches in diameter and smaller shall conform to ANSI Standard D36.10.

Fittings

Unless otherwise shown on the Plans, all specials and fittings shall conform to the dimensions of AWWA C208. Pipe material used in fittings shall be of the same material and pressure class as the adjoining pipe.

Buried elbows shall have a minimum radius equal to 2½ times the pipe diameter and the maximum miter angle on each section of the elbow shall not exceed 11¼-degrees (one cut elbow up to 22 ½-degrees). Aboveground elbows shall have a radius equal to 1 times the pipe diameter. If elbow radius is less than 2½ times the pipe diameter, stresses shall be checked per AWWA M11 and the pressure class increased if necessary.

Specials and fittings, unless otherwise shown on the Plans, shall be made of segmental welded sections from hydrostatically tested pipe, with ends compatible with the type of joint or coupling specified for the pipe. All welds made after hydrostatic testing of the straight sections of pipe shall be tested per the requirements of AWWA C200 Section 5.2.2.1.

Joints

Rolled Groove or Carnegie Rubber Gasket Joint

1. The standard joint for buried piping shall be a rolled groove or Carnegie rubber gasket joint unless otherwise noted on the Plans. Joints and gaskets shall conform to AWWA C200 and as shown in Chapter 8 of AWWA M11.
2. The joint shall be suitable for a working pressure equal to the class of pipe furnished and shall operate satisfactorily with a deflection angle, the tangent of which is not to exceed 1.00/D where D is the outside diameter of the pipe in inches with a pull-out of 1-inch.
3. Carnegie and rolled groove rubber gasket joints may be furnished only by a manufacturer who has furnished pipe with joints of similar design for comparable working pressure and pipe diameters that has been in successful service for a period of at least 5 years.

Lap Weld

1. Lap weld joints shall conform to AWWA C200 and as shown in Chapter 8 of AWWA M11.
2. Use lap field welded joints where restrained joints are required or indicated on the Plans. The standard bell shall provide for a 2 ½-inch lap. The minimum lap shall be 1-inch. The maximum joint deflection or offset shall be a 1-inch joint pull.
3. Lap welded joints shall be welded either externally or internally. Provide holdbacks for coating and linings as shown on the approved shop drawings. "Weld-after-backfill" of interior welds may be performed any time after joint completion and backfilling has been completed.

4. Unless otherwise shown on the Plans, all field joints shall be lap welded for diameters 48-inches and greater. Joints on pipe less than 48 inches in diameter may be lap-welded, rolled groove or Carnegie rubber gasket joints.

Mechanical Couplings

1. Mechanical couplings where indicated on the Plans shall be Romac 400, Smith Blair Style 411, Baker Style 200, Victaulic Depend-O-Loc or equal.
2. Insulating mechanical couplings where indicated on the Plans shall be double insulated Romac IC400, Smith Blair Style 416, Baker Style 216, or equal for working pressures up to 150 psi only.
3. Couplings for buried service shall have all metal parts painted with epoxy paint and conform to AWWA C210.
4. Pipe ends for mechanical couplings shall conform to AWWA C200 and M11. The shop applied outside coating shall be held back as required for field assembly of the mechanical coupling or to the harness lugs or rings. Paint harness lugs or rings and pipe ends with one shop coat of epoxy conforming to AWWA C210.
5. Pipe for use with sleeve-type couplings shall have plain ends at right angles to the axis.

Flanges

1. Steel flanges smaller than 4-inch per ANSI B16.5, Class 150 or Class 300. Steel flanges 4-inches and larger per AWWA C207. All flanges rated for the specified working and hydrostatic testing pressures, but in no case shall be less than Class D. Supply documentation that flanged ends welded to the steel pipe and welded pieces are capable of the hydrostatic testing pressure.
2. Shop lining and coating shall be continuous to the end of the pipe or back of the flange. Flange faces shall be shop coated with a fusion bonded epoxy coating.
3. Gaskets shall be 1/8-inch thick minimum. Fasteners per Division 15.21.

AWWA C207 Flanges			
Flange Class	Diameter	Working Pressure	**Maximum Test Pressure**
D	4-inch to 12-inch	175 psi	218 psi
E	4-inch and larger	275 psi	343 psi

Submittals

Shop drawings and calculations shall be submitted to the Engineer for review and approval prior to material order, including:

1. Wall thickness and diameter. Calculations for pipe design and fittings reinforcement and/or test data.
2. Layout showing the overall system with all major dimensions, stations, and elevations. Each piece shall be identified by mark number referenced to a pipe laying schedule and detail sheet.
3. Details of standard pipe, joints, specials, and fittings.
4. Calculations, details, and locations of joint restraint for thrust restraint.

5. Details of joint bonding and field welded joint restraint calculations.

The Contractor shall submit previous experience of a minimum of five steel welding projects similar to this one. If requested by the Owner, supply specification of previous projects and written documentation that the construction met the specification.

Part 2 - Products

Source Quality Control

Pipe cylinders, lining, coating, and fabrication of specials shall be the product of one manufacturer that has not less than 5 years successful experience manufacturing pipe of the type and size indicated. For projects containing 1,000 lineal feet or less of buried steel piping or for project involving both aboveground and buried steel piping, the products of up to two different manufacturers provided that each has not less than 5 years successful experience manufacturing pipe of the particular type and size indicated.

The pipe manufacturer must have a certified quality assurance program, ISO 9001:2000 or other equivalent nationally recognized program as approved by the Owner.

Welds shall be constructed in accordance with ASME Welding Code. The Contractor shall be responsible for compliance to this tolerance and correct any dimensions or welding that does not meet this specification at their expense.

All pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of AWWA C200 and AWWA coating and lining standard as supplemented by the requirements herein.

Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of AWWA C200 and AWWA coating and lining standards.

The Contractor shall perform required tests at no additional cost to the Owner. The Engineer shall have the right to witness all testing conducted by the Contractor. The Contractor shall provide a minimum of 48 hours advance notice of any testing.

All welding procedures used to fabricate pipe shall be qualified under the provision of AWS B2.1 or ASME Section IX.

Skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used shall do all welding. Welders shall maintain current qualifications under the provisions of AWS B2.1 or ASME Section IX. Machines and electrodes similar to those in the work shall be used in qualification tests. The Contractor shall furnish all material and bear the expense of qualifying welders.

Internal bracing shall be provided for shipment if needed to maintain pipe shape.

Finishes

Aboveground Steel Pipe and Fittings: Lining and coating per Division 9.90.

15.22.08 Brass/Bronze Pipe and Fittings

[CSI 33 05 12 or 40 05 12]

Part 1 - General

References

Brass to be low-lead content in compliance with NSF/ANSI 372 to have no more than 0.25 percent lead content.

Brass nipples: ASTM B687

Brass fittings: ANSI/ASME B16.15 (threaded) Class 125 lb. (up to 200 psi water), 250 lb. (up to 400 psi water); B16.18 (soldered).

Part 2 - Products

Materials

Brass pipe, nipples, and fittings to have threaded ends.

15.30 VALVES

15.31 Common Work for Valves

[CSI 40 05 51 or 33 14 19]

Part 1 – General

Design and Performance Requirements

Valves noted on the Plans or in other parts of the Specifications shall meet the requirements herein. Valves shall be designed for the intended service.

Valve suppliers shall review the design and certify that the valve provided in the submittal is appropriate for the application and will operate as shown and described. Any discrepancies from the design and the valves shall be brought to the Engineer's attention during the bidding process. Valves that do not operate as specified and per normal industry standards shall be replaced or modified so that they operate within the design parameters at the Contractor's expense.

Pressure rating shall be per Division 1.81.40 unless shown otherwise.

Part 2 – Products

Components

If shear pins are installed with any valve, the manufacturer shall certify the shear pin(s) to fail between 95 to 99 percent of the operator shaft failure torque. Provide concrete supports for operators where required, as shown on the Plans.

Buried valves shall be equipped with an AWWA 2-inch wrench nut with a minimum of 10 turns required to close the valve, unless otherwise noted on the Plans. Exposed valves shall be equipped with lever actuator for valves 3 inches and smaller, or handwheel actuator for valves 4 inches and larger, unless otherwise noted on Plans.

Buried valves where the operator nut is more than 3 feet below the valve box lid shall be provided with a solid shaft valve nut extension to reach between 18-inches and 30-inches of the ground surface. Extension shall attach to the nut with a set screw. Diameter of extension shall be appropriate for the valve size and length of extension, but under no circumstances shall be less than 1 inch for 4-foot-long extension rods, or 1.25 inch for rods longer than 4 feet. Extension shall function without excessive twisting.

Part 3 - Execution

Installation

Install valves in strict accordance with the manufacturer's instructions and as shown on the Plans. Verify alignment and adjustments after installation. Provide buried valves with all operators or valves boxes installed so that wrenches or operators perform freely and without binding or other interference. Bed and backfill buried valves according to the requirements of the pipe to which they are attached.

15.32 Isolation Valves

15.32.02 Resilient Wedge (Seat) Gate Valves

[CSI 40 05 61.23]

Part 1 – General

Design Requirements

All gate valves for water lines 3 inches and larger shall be of the resilient, wedge-type, and shall meet or exceed the performance requirements of AWWA C509 or AWWA C515-Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service, unless shown otherwise. Valves shall be suitable for installation with the type and class of pipe being installed. The wedge shall be fully encapsulated with vulcanized SBR rubber or EPDM. Ends as shown on the plans. Valve opening direction shall be counter-clockwise.

Part 3 - Execution

Field Quality Control

Where buried valves will be installed in a horizontal orientation and for buried valves 16-inch and larger in any orientation, operate the valve over the full range of travel in both directions prior to installation in the presence of the Owner to verify gate travels smoothly and without binding. Service or replace valves that do not travel smoothly.

Installation

Install valves in strict accordance with manufacturer's instructions and as shown on the Plans. Verify alignment and adjustments after installation. Provide buried valves with all operators or valve boxes installed so that wrenches and operators perform freely and without binding or other interference. Bed and backfill buried valves according to requirements of the pipe to which they are attached.

15.32.07 Gate Valves – Small Diameter

[CSI 40 05 61.13]

Part 2 – Products

Manufactured Units

Gate valves 2 inches and smaller for steel or brass pipe shall be Crane No. 438 or equal with non-rising stem, screwed bonnet, solid wedge disc, bronze construction and threaded ends.

Gate valves 2 inches and smaller for copper piping shall be Crane No. 1320 or equal with stem, screwed bonnet, solid wedge disc, bronze construction and solder or screw ends.

15.33 Check Valves

15.33.02 Swing Check Valves

[CSI 40 05 65.23]

Part 1 – General

Design Requirements

The swing check valve shall function to permit flow in only one direction. The valve shall close tightly, without slamming, when the pressure on the discharge side exceeds the pressure on the inlet side. All swing check valves shall conform with AWWA C508 and the following specifications.

The valve shall be constructed to withstand the pressures stated in Division 1.82.

Operating pressure range is 10psi (low) to 140 psi (high). The manufacturer shall certify that the check valve will seal completely within the operational range.

Part 2 – Products

Manufacturers

The valve shall be equal to Golden Anderson Fig. 220-DS/US swing check valve or M&H Model 159 Swing Check Valve. Valve swing arm shall be weighted. Swing arm shall be oriented as shown on the plans. If not shown, swing arm shall be located to be free to move without restriction.

Manufactured Units

The swing check valve body shall be constructed with heavy cast iron or cast steel and have a bronze or stainless-steel seat ring, rubber clapper facing, a non-corrosive shaft and external counterweight attachment. See Plans for which side of the valve to locate the counterweight.

A limit switch shall be included and mounted to the valve body for remote indication of valve position.

Provide a complete shockless cushion chamber, installed. The cushion chamber shall be attached to the side of the valve body externally and constructed with a piston operating in a chamber that will effectively permit the valve to operate without a hammering action. The

piston shall compress air in the chamber to develop a shock absorbing action. The counterweight location and air chamber relief valve shall be adjustable.

The valve disc shall be constructed of cast iron or cast steel and shall be suspended from a non-corrosive shaft. The valve shall allow the equivalent flow area of the adjoining pipe. The shaft shall pass through a stiffing box and be connected to the swing arm in the outside of the valve.

Finishes

The interior and exterior of the valve body, bonnet and seal plate shall be coated with fusion-bonded epoxy meeting AWWA C-550 (latest revision). Interior coating shall be a minimum dry film thickness of 7 Mils, not including primer. Exterior coating shall be a minimum dry film thickness of 5 Mils, not including primer. Alternatively, exterior may be coated per Division 9.90.

15.34 Pilot-Operated Control Valves

15.34.01 Common Work for Pilot-Operated Control Valves

[CSI 40 05 65.05, 40 05 67.05]

Part 1 – General

Submittals

Valve suppliers shall review the design and certify that the valve provided in the submittal will operate as described and within the conditions specified. Any discrepancies from the design and the specified valves shall be brought to the Owner's attention during the submittal process.

Performance Requirements

Valves shall be designed for the intended service. Install valves in strict accordance with manufacturer's instructions and as shown on the Plans.

Valves that do not operate as intended shall be replaced or modified so that they operate within the design parameters at the Contractor's expense.

All valves shall be rated for the pressures shown in Division 1.81.40, unless stated otherwise within the individual valve specification.

Part 2 – Products

Manufactured Units

Valves shall be diaphragm-actuated, hydraulically-operated valves and shall have a cover chamber sealed from the body by a flexible, synthetic rubber diaphragm. Control of the valve shall be from direct-acting, adjustable spring-loaded diaphragm valve(s) and/or solenoid valve(s) as appropriate for the valve function. Pilot controls shall be selected appropriately for the system operational pressure range. Double chamber valves shall be used where independent operating pressure or absolute speed control is required. Double chamber valves shall also be used where line pressure is insufficient to operate the pilot system and a second pressure source is available. All pump control valves shall be double chamber. Valves to be globe or angle style with flanged or threaded ends as shown on the Plans.

Components

Provide brass or SS nameplates on all valves indicating valve size, inlet side (or flow direction), valve model and control pilot adjustment ranges.

Provide valves with all pilots, solenoids and controls preassembled to operate the valve in its intended function. Solenoids shall be powered by 120 VAC current. Provide each valve with stainless steel trim. Diaphragm shaft shall be stainless steel.

Provide a valve position sight gauge equal to Cla-Val model X101 for the following valves.

- Pressure Relief Valve

Limit switches equal to Cla-Val X105L (single) or X105L2 (dual) series. Mount on the valve position indicator.

Finishes

Provide all hydraulic control valves with an epoxy coating on the interior flow path and exterior body. Interior epoxy shall be certified for potable water use.

Field Quality Control

The valve manufacturer's representative shall inspect the installation prior to operating or field testing. A field test shall be conducted and/or supervised by the valve manufacturer's representative after the piping and controls have been installed. Upon completion of installation and testing, manufacturer's representative shall provide written certification that equipment is fully warranted installed.

15.34.31 Pressure Relief Valves – Pilot-Operated Control

[CSI 40 05 67.39]

Part 2 – Products

Manufacturers

Valves shall be a Cla-Val Model 50-01/650-01 pressure relief valve.

Manufactured Units

Pressure relief valve control shall be designed to modulate flow to maintain constant upstream pressure within close limits. In operation, the valve opens fast to maintain steady line pressure but closes gradually to prevent surges. Provide valve with the capability that if a pressure reversal occurs, the valve closes drip-tight to prevent return flow.

Factory pressure relief setting of 132 psi. Maximum pressure differential across the valve is expected to be 120 psi.

15.40 PIPING SPECIALTIES

15.40.01 Dismantling Joint

[CSI 40 05 06.13]

Part 1 – General

Design Criteria

Dismantling joint shall be accessible and capable of repeated installations and removals and capable of the testing and working pressures as specified in Division 1.81.40. Joint adjustment range of no less than 2-inches for 12-inch diameter and smaller pipe, and 3-inches for 14-inch diameter and larger pipe. Joint assembly to include limiting rods to prevent pull-out.

Part 2 – Products

Manufacturers

Dismantling joint shall be Romac DJ400 with limit rods or equal.

Part 3 – Execution

Installation

Install per the manufacturer's instructions. Set the assembly at the midpoint of the adjustment range unless specifically called out otherwise on the Plans.

15.40.03 Pipe, Valve, and Conduit Supports

[CSI 40 05 07]

Part 1 - General

Summary

This section includes providing pipe supports, hangers, guides, and anchors.

Related Sections

- Division 1.81.30 Seismic Restraint
- Division 5.05.23 Bolts and other Connectors

References

Pipe supports furnished under this section shall comply in all respects with the requirements of the following standards.

- ANSI/ASME B31.1 Power Piping
- ANSI/MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture
- ANSI/MSS SP-69 Pipe Hangers and Supports - Selection and Application

Performance Standards

Piping systems, including connections to equipment, shall be properly supported to prevent deflection and stresses. Supports shall comply with ANSI/ASME B31.1, except as otherwise indicated.

Size hanger rods, supports, clamps, anchors, brackets, and guides in accordance with ANSI/MSS SP 58 and SP 69.

Support plumbing drainage and vents in accordance with the Uniform Plumbing Code.

Submittals

Pipe Hanger/Support Design Calculations

Shop drawings of engineered pipe hangers/supports, including details of concrete inserts. Drawings shall include location plan showing location of the hanger/support in relation to the structure and/or equipment.

Part 2 – Products

Manufacturers

Pipe supports, hangers, guides, and anchors shall be Anvil, Unistrut, Tolco, Standon, or equal.

Flange supports shall be equal to Standon Adjustable Model S89 Flange Support. Pipe supports shall be equal to Standon Adjustable Model S92 Pipe Support. Both flange and pipe supports shall be equal to those manufactured by Material Resources, Hillsboro, Oregon.

Components

Provide and install all equipment necessary for compete support systems including, but not limited to, base, riser pipe, anchor bolts, hanger rod, support cradle or clamp, and fasteners.

Except as otherwise noted, pipe support components shall comply with the types in ANSI/MSS SP-58.

Freestanding Piping: Freestanding pipe connections to equipment, including chemical feeders and pumps, shall be firmly attached to fabricated steel frames made of angles, channels or I-beams anchored to the structure. Exterior, freestanding overhead piping shall be supported on fabricated pipe stands, consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles, and U-bolts or clamps installed to secure piping.

Point Loads: Any meters, valves, heavy equipment and other point loads on PVC, fiberglass and other plastic pipes shall be supported on both sides according to the manufacturer's recommendations to avoid pipe stresses. Supports on plastic and fiberglass piping shall be equipped with extra wide pipe saddles or stainless-steel shields. No support shall have metal pieces in contact with plastic process piping.

Finishes

Unless otherwise noted, all fabricated pipe supports, other than stainless steel or non-ferrous supports, shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM 123. Other than stainless steel and non-ferrous supports, supports shall be coated in accordance with Division 9.90.

Part 3 - Execution

Installation

Piping shall be rigidly anchored to walls, slabs, and ceilings by means of suitable pipe supports, wall brackets, or pipe hangers.

Pipe supports, hangers, brackets, anchors, guides, and inserts shall be installed in accordance with the manufacturer's installation instructions and ANSI/ASME B31.1. All concrete inserts for pipe hangers and supports shall be coordinated with the formwork.

Stand-on Pipe Support: Adjust support, secure to pipe and secure to floor as recommended by the manufacturer.

Riser Supports: Risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.

Support Spacing: Pipe supports shall be placed to meet the following maximum spacing, unless otherwise noted or shown on the Plans: maximum vertical support spacing of 5 feet, and maximum horizontal support spacing of 10 feet. Support shall be provided at horizontal bends, base of risers (vertical bends), floor penetrations, connections to pumps, blowers, and other equipment, valves and appurtenances. Support spacing shall meet the local plumbing code where applicable. Support spacing may be increased from that noted above provided adequate calculations are provided supporting the change.

Support Anchorage: Concrete anchors shall be as specified in Division 3, Concrete Anchors. All channel strut type supports shall have a minimum of 2 anchors per support.

Suspend pipe hangers from hanger rods, secure with double nuts.

Securely anchor plastic pipe, valves and headers to prevent movement during operation of valves. Anchor plastic pipe between expansion loops and direction changes to prevent axial movement through anchors.

Provide ductile iron elbows or tees supported from floors with base fittings. Support base fittings with metal supports, or when indicated on the Plans, concrete piers.

Do not use chains, plumbers' straps, wire, or similar devices for suspending, supporting or restraining pipes.

Install riser clamps at floor penetrations and where indicated on the Plans.

Field Quality Control

Pipe supports and hangers shall be positioned in such a way as to produce an orderly, neat piping system. All hanger rods shall be vertical, without offsets. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, without interference with other work.

Properly support, suspend or anchor exposed pipe, fittings, valves and appurtenances to prevent sagging, overstressing or movement of piping and to prevent thrusts or loads on or against connected pumps, blowers or other equipment.

15.50 FLOW METERS

[CSI 33 19 00 or 40 71 00]

15.50.05 Common Work for Flow Meters

[CSI 33 19 05 or 40 71 05]

Part 1 - General

Design Criteria

Meter body and register shall have a pressure rating in accordance with Division 1.81.40. Materials, coatings, and components shall be appropriate for the fluid being measured. Meters will be installed inside the pump station with an anticipated ambient temperature range between 40- and 100-degrees Fahrenheit.

Submittals

Meter shall fit in the space provided on the Plans. Meters that do not fit in the space provided must be approved by the Engineer for acceptance along with the Contractor's proposed modifications to accommodate the meter.

Provide information on meter assembly, available and selected options, readout head, remote transmitter, coatings, and dimensions of all equipment.

Part 2 - Products

Components

Each meter shall be equipped with an indicator-totalizer device.

- Panorama Meter with Digital readout head with electronic output per Division 15.51.5

Part 3 - Execution

Installation

Install the meter in strict accordance with the manufacturer's recommendation.

Field Quality Control

Installation shall be inspected by manufacturer's representative prior to operating or field testing units. A field test shall be conducted and/or supervised by the meter manufacturer's representative after the piping and controls have been installed. Flow meters shall be inspected and verified by factory trained technicians. Upon completion of installation and testing, manufacturer's representative shall provide written certification that equipment is fully warranted installed.

Testing

If a meter approved by the Owner is not rated for the system test pressure, a temporary spool, flange(s), or cap(s) must be installed in place of the meter. A visual leak test will be performed under working pressure with the meter in place.

The Contractor shall prove correct meter and transmitter performance. Should performance not be acceptable, adjust or replace the unit at the Contractor's expense.

15.51 Flow Meter Readout Head

[CSI 33 09 01, 33 19 90 or 40 71 90]

15.51.05 Digital Read Head with Electronic Output

[CSI 33 09 01.33, 33 19 94 or 40 71 94]

Part 2 - Products

Components

The totalizer shall read in units of hundreds of gallons.

Readout shall be gallons per minute (gpm) for instantaneous flow.

The transmitter shall provide a contact closure (digital pulse) switch and a loop-powered current output (analog) for connection to the instrumentation system. The pulse output shall be plus or minus 2 percent of actual flow with the range specified for each meter. One pulse shall represent 100 gallons of flow.

The current output shall be a 4-20 mA signal that represents the rate of flow through the meter. Scale the transmitter as follows: 0 gpm minimum and 1,000 gpm maximum. The current output shall be plus or minus 0.5 percent of full scale of the instrument the transmitter is controlling.

Transmitter electronics shall consist of easily accessible printed circuit boards for convenient maintenance in a wall mountable NEMA 4X (standard) enclosure and connected to the transducer by cable. The meter manufacturer shall supply an unspliced cable run from the transmitter to the meter tube.

Provide an enclosure with window, that does not negate the enclosure NEMA rating, for viewing the flow rate and totalizing counter on an LCD readout. The transmitter shall display flow rate in gallons per minute, totalized gallons, and an empty pipe indicator.

The electronics shall be NEMA 4X rated. Output shall be 4-20 mA into 800 Ohms with an isolated ground and non-interacting zero and span adjustments. The display and output shall be user scalable for GPM, CFS, or MGD, and shall be password protected.

The meter, electronics, and transmitter shall be RFI shielded to prevent interference from adjacent high noise electrical equipment such as variable frequency drives, electromagnetic starters, transformers, or transfer switches.

Provide the necessary interface between remote instrumentation and the transmitter. Provide a meter with power and signal wiring as recommended by the manufacturer. Ground instrumentation shall be as recommended by the manufacturer.

Part 3 - Execution

Installation

Connect outputs to telemetry or data logging system.

Install the remote readout head where shown on the Plans. If not shown on the Plans, confirm location with Engineer prior to installation.

15.53 Electronic Flow Meters

15.53.03 Electromagnetic Flow Meters

[CSI 33 19 23 or 40 71 13.13]

Part 1 - General

Related Sections

- 15.51.05 Digital Read Head with Electronic Output

Design Requirements

Provide an electromagnetic flow metering system suitable for measuring and transmitting flow rate in a full-flowing pipe. The meter shall be suitable for either horizontal or vertical mounting. The system shall operate within the accuracy required over an ambient temperature range of -10 to +120 degrees Fahrenheit and a process temperature range of +15 to +120 degrees Fahrenheit.

Performance Requirements

The flow meter system shall be microprocessor based, utilizing a DC bipolar pulsed coil that automatically re-zeroes after each pulse cycle. System accuracy shall be ± 1 percent of actual flow rate over a fluid velocity range of 1 to 30 feet per second (fps), and within 0.01 fps for velocities less than 1 fps. Repeatability shall be 0.1 percent of full scale or better. System accuracy shall be traceable to NIST using prototype meters of the same configuration.

Part 2 - Products

Manufacturers

The flow meter shall be Endress and Hauser Proline Promag W 400, or approved equal.

Manufactured Units

The meter tube and coil shall be mounted on the pipe between ANSI B16 pipe flanges and rated for working and test pressures as indicated in Division 1.81.40. The meter tube shall be 304 or 316 stainless steel. The meter and cable connection(s) shall be capable of complete submergence without damage. The meter shall include integral grounding electrodes, or 316 stainless steel or Hastelloy C grounding rings for installation at the inlet. The manufacturer shall verify that the grounding system is appropriate for the proposed use. All wetted parts shall be 316 stainless steel.

When grounding rings are used, select gaskets with an inside diameter large enough that the gasket cannot wrap over the exposed edge of the grounding ring, blocking it from the process fluid.

Finishes

The meter liner shall completely encapsulate all wetted areas except for electrodes. The liner shall be certified by the manufacturer as appropriate for the proposed use. The liner shall be rated for drinking water contact.

The meter supplier shall review the liner material specified and confirm that it is appropriate for this project fluid and process. Provide submittal information that the liner material is fully compatible with the liquid it is carrying.

15.60 PRESSURE MEASUREMENT

[CSI 40 73 00]

15.60.01 Common Work for Pressure Measurement

[CSI 40 73 05]

Part 1 – General

Related Sections

- Division 17 - Electronic Pressure and Level Devices

Design Requirements

Pressure and level measurement devices shall be scaled and rated for the application.

Part 3 – Execution

Installation

All devices shall be installed to be field serviceable without taking the facility out of service. Readouts shall be positioned to be easily read from a standing position and central to the room, unless otherwise allowed by the Engineer.

15.61 Pressure Gauges

[CSI 40 73 13]

Part 1 – General

References

- ASME B40.100 (B40.1 Analog, B40.7 Digital)

Performance Requirements

Analog: Grade 2A (±0.5 percent of span) unless stated otherwise in the Products section.

Digital: Grade 2A (±0.5 percent of span) or AR (±1 percent of reading) unless stated otherwise in the Products section.

Submittals

Provide catalog sheets showing dimensions, pressure range, accuracy and optional accessories.

Part 2 – Products

Manufacturers

Marsh, 3D Instruments, or approved equal.

Materials

Provide gauges per the table below. Gauges completely suitable for measuring potable water with wetted parts of brass, bronze, or stainless steel.

Location	Suction Header	Discharge Header and Pressure Tanks
Full Scale	0-60 psi	0-200 psi
Normal Operating Range	10-20 psi	70-130 psi
Analog or Digital	Analog	Analog
Surface or Stem Mount	Surface	Surface
Connection Size	0.5"	0.5"
Glycerin fill or Dry	Glycerin	Glycerin
Face Size	4.5”	4.5”

Part 3 - Execution

Installation

Install gauges where shown on the Plans. Support gauges adequately. Tighten only with the connection hex nut, do not twist the case.

Field Quality Control

Where a new gauge is connected directly to the plumbing of a pressure transmitter, the gauge must read within its accuracy grade compared to the transmitter, unless the transmitter is proven faulty.

If the Engineer suspects any gauge is inaccurate, provide a calibrated gauge for comparison, or other method of verification acceptable to the Engineer.

Replace or calibrate gauges that do not meet the accuracy requirements.

15.70 PLUMBING

[CSI 22 00 00]

15.70.05 Common Work for Plumbing

[CSI 22 05 00]

Part 2 – Products

Components

Joints and Connections

- Steel and Brass: Use factory-cut pipe threads where possible; otherwise, cut pipe ends square, remove all fins and burrs, and cut full-depth tapered threads. Apply joint compound to male threads only and engage so that no more than three threads remain exposed.
- Copper: Make all joints in copper tubing with 95-5 tin-antimony solder applied in strict accordance with manufacturer's recommendations. Flared connections are only allowed in exposed locations.
- Hubless: Install a neoprene gasket and stainless steel clamp and shield coupling joint assemblies with bolts alternatively and incrementally tightened to a minimum 60 inch-pounds torque. Use a single set-point torque wrench manufactured specifically for this purpose. Do not use screwdrivers or other types of wrenches. Re-torque bolts after 24 hours.
- Solvent cement: Use solvent cement approved by pipe and fitting manufacturer and apply in accordance with the manufacturer's installation procedures.

Fixtures and Trim

Use chromium-plated brass bolts, nuts and washers where exposed; otherwise, use brass or bronze bolts, nuts and washers. Make connections gas-tight and water-tight. Do not use bulk material, including putty and plastics, for gaskets.

Trim shall match metal parts used with fixtures. Trim shall be stainless steel, except when provided with plumbing fitting by the manufacturer. Exposed trim shall have a satin type finish. Escutcheons shall be provided at each point where pipe or other fittings enter the wall.

Part 3 - Execution

Examination

Prior to work of this section, carefully inspect installed work of other trades and verify that such work is complete to the point where this installation may properly commence. Verify that plumbing may be installed in strict accordance with all pertinent codes and regulations. In the event of a discrepancy, do not proceed with the installation and immediately notify the Owner.

Installation

Install and locate pipe, fittings and accessories as shown on the Plans.

Waste piping vents shall protrude through the roof. In framed walls, waste piping vents shall be concealed. Provide individual vents for each fixture.

Except for drain grates, do not embed plumbing in concrete or masonry, always surface mount. Where furring exists, conceal in furring unless shown otherwise on the plans. Where plumbing passes through concrete or masonry, provide a sleeve unless specifically shown otherwise on the plans.

Rigidly support wall hung fixtures by means of metal supporting members so that no stress is transmitted to connections.

Do not cut into or reduce the size of any load-carrying member without prior approval of the Engineer. Install pipes to clear all beams and obstructions.

Locate water hammer arresters in accordance with the manufacturer's recommendation.

Provide uniform pitch of at least $^{1}/_{8}$-inch per foot, or as otherwise noted, for all horizontal waste and drain piping within the building. Pitch all vents for proper drainage.

Cushion all traps and bearings to minimize transfer of sound; firmly anchor all pipes in position.

Vertical stacks shall be supported at floors with clamp anchors as required to relieve joint stresses.

Conceal all piping unless otherwise shown on the Plans.

Provide and conceal air chambers the same size as the branch line at each water connection to a plumbing fixture.

Inspection

Test all plumbing fixtures for proper and smooth operation when in use.

Make sure fixtures are thoroughly clean and free of any foreign material.

15.72 Pressure Tank

[CSI 22 12 00 or 43 42 00]

15.72.02 Bladder Tank

[CSI 22 12 23.13 or 43 42 13]

Part 1 – General

Design Criteria

Minimum 1-inch diameter piping connection.

119-gallon minimum total capacity.

150-psi working pressure rated. Non-ASME rated.

Air connection for pre-charging.

Part 2 – Products

Manufactured Units

Amtrol Well-X-Trol WX350 or approved equal. Provide pressure relief valve with tank between isolation valve and tank. PRV shall open at 142 psi. Route pressure relief valve outlet water to floor drain trough with proper 2 pipe diameters air gap.

Finishes

Factory Coating.

Part 3 – Execution

Installation

Provide and install union and ball valve for removal of tank without taking water system out of service. Locate valve, union, and air fitting on accessible side of tank.

If not shown otherwise on plans, anchor tank to floor using two 2"x2"x1/2" "L" bracket and ½-inch concrete anchors.

Follow manufacturer's instructions for setting air pressure. Do not connect tank to active water supply unless instructions are on site. Failure to follow instructions may damage the bladder.

Drain line shall have isolation valve and drain pipe/hose connected to floor drain inlet. Each tank shall have a drain valve and a common drain valve with common header for multiple tank setup.

15.75.21 Unions

[CSI 40 05 06]

Part 2 – Products

Manufactured Units

As shown on the Plans, unions shall be water tight, capable of pressure forces of the pipe it is connected to, and allow a minimum of ¼-inch of play for installation and maintenance flexibility. Unions shall be threaded to match the pipe it connects and match the pipe material (copper, brass or PVC).

15.75.22 Quick Disconnect Fittings

[CSI 40 05 06 or 40 05 89.33]

Part 2 – Products

Manufacturers

Couplers shall be equal to Harrington Model 153 quick disconnect fittings cam operated couplings. Hose clamps shall be equal to Ryan Herco snapper hose clamps.

Manufactured Units

Quick disconnect fittings shall be a cam-type coupling fabricated from glass-filled polypropylene. Couplers shall mate with other couplers, both metal and plastic, and shall be manufactured to Mil-C-27487 dimensions. Install couplers on both ends of braided vinyl hose.

Connect quick disconnect fittings to braided vinyl hose using a non-corrosive hose clamp fabricated from an acetyl copolymer. Hose clamps shall be pressure rated for the pressures identified in Division 1.81.40.

15.75.41 Hose

[CSI 22 11 19.15]

Part 2 – Products

Materials

Hoses shall be stainless steel braded with NSF or food grade materials in contact with potable water. Hoses shall be equal to United Flexible AFCXI or Hosecraft USA TS1 PTFE Smooth Bore Braided Hose. Size as required by pipe it adjoins and NPT Male/Female as required by what it attaches to. Provide dielectric couplings to dissimilar metal if in contact.

Connections to expansion tanks shall be 1-¼" NPT ends, male or female.

Hose and connections shall have a working pressure rating of 150 psi or greater.

Division 16
Electrical

16.00 GENERAL

The Contractor shall provide all labor, material, tools, equipment and services required to complete the furnishing, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical equipment, devices and components as indicated and implied by the plans and specifications.

Sections in these specifications titled "*Common Work for . . .*" shall apply to all following sections whether directly referenced or not.

The Contractor shall reference Division 1.25 regarding substitutes and "or-equals".

16.05 Common Work for Electrical

Part 1 - General

Summary

Plans are diagrammatic and indicate general arrangements of systems and equipment, except when specifically dimensioned or detailed. The intention of the plans is to show size, capacity, approximated location, direction, and general relationship of one work phase to another, but not exact detail or arrangement.

Regulatory Requirements

The Contractor shall coordinate and provide all permits, licenses, approvals, inspections by the authority having jurisdiction and other arrangements for work on this project and all fees shall be paid for by the Contractor. The Contractor shall include these fees in the bid price.

Related Sections

See the following sections for items that may be provided and/or installed with other electrical equipment.

- Division 11.20 Pump motors
- Division 17.50 Sensors and controls

Codes and Standards

Provide all electrical work in accordance with latest edition of National Electrical Code, National Electrical Safety Code, Washington State Electrical Code, and local ordinances. If any conflict occurs between government adopted code rules and these specifications, the codes are to govern. All electrical products shall bear a label from a certified testing laboratory recognized by the State of Washington. Recognized labels in the State of Washington are UL, ETL, and CSA-US.

Definitions

Dry Locations: All those indoor areas which do not fall within the definitions below for wet, damp, or corrosive locations and which are not otherwise designated on the Plans.

Wet Locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Plans.

Damp Locations: All spaces wholly or partially underground, or having a wall or ceiling forming part of a channel or tank unless otherwise designated on the Plans.

The words "plans" and "drawings" are used interchangeably in this specification and in all cases shall be interpreted to mean "Plans".

The word "provide" shall be interpreted to mean furnish and install.

Design Requirements

Unless otherwise noted, provide enclosures as follows:

1. Indoors Unclassified Locations: NEMA Type 12
2. Outdoors and/or Wet Locations: NEMA Type 4X
3. Electrical Rooms: NEMA Type 1

Submittals

Provide submittals of each item specified in this division to engineer for approval in accordance with Division 1 of these specifications. Submittals for motor control centers, motor control panels, control panels, instrumentation panels, and pump control panels shall include at a minimum: a wiring diagram or connection schematic, and an interconnection diagram.

Wiring Diagram or Connection Schematic

1. Include all devices in a system and show their physical relationship to each other including terminals and interconnecting wiring in assembly. This diagram shall be in a form showing interconnecting wiring only by terminal designations (wireless diagram).

Interconnection Diagram

1. Show all external connections between terminals of equipment and outside points, such as motors and auxiliary devices. Show references to all connection diagrams which interface to the interconnection diagrams. Interconnection diagrams shall be of the continuous line type. Show bundled wires on a single line with the direction of entry/exit of the individual wires clearly shown. Identify all devices and equipment. Show terminal blocks as actually installed and identified in the equipment complete with individual terminal identification. All jumpers, shielding and grounding termination details not shown on the equipment connection diagrams shall be shown on the interconnection diagrams. Show spare wires and cables.

Provide submittal information for the following items:

1. Variable Frequency Drives
2. Circuit Breakers
3. Conduit and Fittings
4. Outlet and Junction Boxes

5. Wire and Cables
6. Other Electrical Components listed in this Division and/or required by the Engineer.

Project Conditions

Contractor shall keep all power shutdown periods to a minimum. Carry out shutdowns only after a shutdown schedule has been submitted and approved by both the Owner and the Engineer.

Construction Power

See Division 1.51

Part 2 - Products

Source Quality Control

Provide adequate space and fit for the electrical installation, including, but not limited to, determination of access-ways and doorways, shipping sections, wall and floor space, and space occupied by mechanical equipment. Provide electrical equipment that fits in the areas shown on the Plans. All equipment shall be readily accessible for maintenance, shall have electrical clearances in accordance with National Electric Code (NEC) and shall be installed in locations which will provide adequate cooling.

Do not use equipment exceeding dimensions indicated or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions unless approved by the Owner.

Identification of Listed Products

Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. When a product is not available with a testing laboratory listing for the purpose for which it is to serve, the inspection authority may require the product to undergo a special inspection at the manufacturer's place of assembly. All costs and expenses incurred for such inspections shall be included in the original contract price.

Materials

Use equipment, materials and wiring methods suitable for the types of locations in which they will be located, as defined in Definitions above.

All materials and equipment specified herein shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.

Components

Fasteners for securing to walls, floors, and the like shall meet the requirements of Division 5.05.23.

Accessories

Wire Identification

1. Identify each wire or cable at each termination and in each pull-box using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as approved by the Engineer. Identify each wire or cable in each pull-box with plastic sleeves having permanent markings. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

Finishes

Refer to each electrical equipment section of these specifications for painting requirements of equipment enclosures.

Part 3 - Execution

Installation

General

1. Complete the wiring, connection, adjustment, calibration, testing and operation of mechanical equipment having electrical motors and/or built-in or furnished electrical components in accordance with electrical code, UL listing requirements and manufacturer's instructions. Install electrical components that are furnished with mechanical equipment.
2. Provide the size, type and rating of motor control devices, equipment and wiring necessary to match the ratings of motors furnished with mechanical equipment.
3. Complete the procurement, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical devices, components accessories and equipment which is not shown or specified but which is nonetheless required to make the systems shown and specified properly functional.

Workmanship

1. Assign a qualified representative who shall supervise the electrical construction work from beginning to completion and final acceptance.
2. Provide all labor using qualified craftsmen, who have had experience on similar projects.
3. Ensure that all equipment and materials fit properly in their installations.

Field Services

1. Provide field services of qualified technicians to supervise and check out the installation of the equipment, to supervise and check out interconnecting wiring, to conduct start-up and operation of the equipment, and to correct any problems which occur during testing and start-up.

Installing Equipment

1. Provide the required inserts, bolts, and anchors, and securely attach all equipment and materials to their supports.
2. Install all floor-mounted equipment on 3½-inch high reinforced concrete pads.
3. Install all equipment and junction boxes to permit easy access for normal maintenance.

Cutting, Drilling, and Welding

1. Provide any cutting, drilling, and welding that is required for the electrical construction work.
2. Structural members shall not be cut or drilled, except when approved by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry. Perform patch work with the same materials as the surrounding area and finish to match.

Metal Panels

1. Mount all metal panels, which are mounted on, or abutting concrete walls in damp locations or any outside walls ¼-inch from the wall and paint the back side of the panels with a high build epoxy primer with the exception of stainless-steel panels. Film thickness shall be 10 Mils minimum.

Load Balance

1. Balance electrical load between phases as nearly as possible on panelboards, motor control centers, and other equipment where balancing is required.
2. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

Field Quality Control

Minor Deviations

1. The electrical plans are diagrammatic in nature and the location of devices, fixtures, and equipment is approximate unless dimensioned. Based on this, the right is reserved by the owner to provide for minor adjustments and deviations from the locations shown on the Plans without any extra cost. Deviations from the Plans and/or specifications required by code shall also be done, subsequent to Owner's approval, without extra cost.
2. Plans indicate the general location and number of the electrical equipment items. When raceway, boxes, and ground connections are shown, they are shown diagrammatically only and indicate the general character and approximate location. Layout does not necessarily show the total number of raceways or boxes for the circuits required. Furnish, install, and place in satisfactory condition all raceways, boxes, conductors, and connections, and all of the materials required for the electrical systems shown or noted in the contract documents complete, fully operational, and fully tested upon the completion of the project.

Project Record Plans

1. A set of Plans shall be maintained at the job site showing any deviations in the electrical systems from the original design. A set of electrical Plans, marked in red to indicate the

routing of concealed conduit runs and any deviations from the original design, shall be submitted to the Owner for review prior to final acceptance.

2. After testing and acceptance of the project the Contractor shall furnish in the O&M manuals an accurate connection schematic and interconnection diagram for every service entrance panel, pump control panel, motor control center, and instrumentation panel provided this project.

Cleanup and Equipment Protection

Equipment Protection

1. Always exercise care after installation of equipment, motor control centers, control panels, etc., to keep out foreign matter, dust debris, and moisture. Use protective sheet metal covers, canvas, heat lamps, etc., as needed to ensure equipment protection.

Cleaning Equipment

1. Thoroughly clean all soiled surfaces of installed equipment and materials upon completion of the project. Clean out and vacuum all construction debris from the bottom of all equipment enclosures.

Painting

1. Repaint any electrical equipment or materials scratched or marred in shipment or installation, using paint furnished by the equipment manufacturer.

Final Cleanup

1. Upon completion of the electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean and acceptable to the Owner.
2. Lamps and fluorescent tubes shall be cleaned, and defective units replaced at the time of final acceptance.

16.15 Grounding and Bonding for Electrical Systems

Part 1 - General

References

Service and equipment grounding shall be per Article 250 of the NEC.

Performance Requirements

Verify that a low-resistance ground path is provided for all circuits so an accidental contact to ground of any live conductor will instantly trip the circuit.

Part 2 - Products

Components

The grounding systems shall consist of the ground rods, grounding conductors, ground bus, ground fittings and clamps, and bonding conductors to water piping and structural steel as shown on the Plans.

System components shall be as allowed in the NEC unless specified otherwise below:

1. Ground Conductors: Buried conductors shall be medium-hard drawn bare copper; other conductors shall be soft drawn copper. Sizes over No. 6 AWG shall be stranded. Coat all ground connections except the exothermic welds with electrical joint compound, non-petroleum type, UL listed for copper and aluminum applications.

Part 3 - Execution

General Grounding Installation

Provide a ground wire in every conduit carrying a circuit of over 110 volts to ground.

Motor Grounding Installation

Extend equipment ground bus via grounding conductor installed in motor feeder raceway. Connect to motor frame.

When using nonmetallic flexible tubing install an equipment grounding conductor connected at both ends to noncurrent-carrying grounding bus.

Ground Connections

Above grade ground connections shall be exothermic weld, mechanical, or compression-type connectors; or brazing.

Below grade ground connections shall be exothermic weld.

Install all ground connections is strict accordance with connector manufacturer's recommendations and methods.

Testing

Following completion of the grounding electrode system, if installed, measure ground resistance at each ground rod using the three-rod method. Submit results to engineer prior to final acceptance by the Owner.

Perform testing per NETA Standard ATS paragraph 7.13. Testing methods shall conform to NETA Standard ATS using the three-electrode method for large systems. Conduct tests only after a period of not less than 48 hours of dry weather.

Furnish to the Engineer a test report with recorded data of each ground rod location. See Division 16.95.4.

16.30 BASIC PANEL EQUIPMENT AND DEVICES

16.31 Operating and Indicating Devices

Part 1 - General

Operating and indicating devices minimum rating shall be NEMA 13. Operator devices mounted in outdoor panels, corrosive areas or where exposed to moisture shall be NEMA 4X.

16.31.2 Run Time Meters

Manufacturers

HECON GO series or equal.

Manufactured Units

Hour meter (elapsed time meters) shall be 2-inch by 1-inch nominal size, rectangular case type for flush panel mounting. The meter face shall be of the style that most closely resembles the panel indicating instruments if provided and shall have black trim with white or aluminized face. The meters shall have a 6-digit non-resettable register with the last digit indicating tenths of an hour.

16.31.3 Start Count Meters

Manufacturers

HECON GO series, Redington Model 3400-2010 or equal.

Manufactured Units

Start counters shall be 2-inch by 1-inch nominal size, rectangular case type for flush panel mounting. The meter face shall be of the style that most closely resembles the panel indicating instruments if provided and shall have black trim with white or aluminized face. The meters shall have a 6-digit resettable register.

16.31.4 Indicating Lights

Manufacturers

Heavy-Duty, Watertight, and Corrosion-Resistant Type:

- Eaton/Cutler-Hammer, Type E34
- Square D Co., Type SK
- Allen Bradley, Type 800H
- General Electric Co., Type CR 104P

Manufactured Units

Indicating lights shall be NEMA type 4/4X/13, corrosion resistant, water-tight, oil-tight, full voltage, push-to-test, high visibility 28 chips LED type. Pilot lights shall be rated for the proper operating voltage. Appropriate lens caps shall be provided as shown on Plans.

16.31.5 Selector Switch

Manufacturers

Heavy-Duty, Watertight, and Corrosion-Resistant Type:

- Eaton/Cutler-Hammer, Type E34
- Square D Co., Type SK

- Allen Bradley, Type 800H
- General Electric Co., Type CR 104P

Manufactured Units

Selector switches shall be NEMA type 4/4X/13, corrosion-resistant/watertight/oil-tight, type selector switches with contacts rated for 10 amperes continuous at proper operating voltage. Operators shall be black knob type. Units shall have the number of positions and contact arrangements and spring return function (if any) as shown on Plans. Units shall be single-hole mounting, accommodating panel thicknesses from $^{1}/_{16}$-inch minimums to ¼-inch maximum.

16.31.6 Pushbuttons

Manufacturers

Heavy-Duty, Watertight, and Corrosion-Resistant Type:

- Eaton/Cutler-Hammer, Type E34
- Square D Co., Type SK
- Allen Bradley, Type 800H
- General Electric Co., Type CR 104P

Manufactured Units

Pushbuttons shall be NEMA type 4/4X/13, corrosion-resistant/watertight/oil-tight, type push buttons with momentary contacts rated for 10-ampere continuous at proper operating voltage. Button color shall be as specified in control panels and shall have a full guard. Pushbutton contact arrangements shall be as shown on Plans. Size of pushbuttons as indicated on the Plans.

Special Functions

Pushbutton for "emergency stop" applications shall have maintained contacts and red mushroom head operators.

16.32 Panel Relays

Part 1 – General

Relays shall be provided as necessary to perform switching functions required of control panels and other control circuits as shown on the Plans and described in the technical specifications. Appropriate relay type and associated contacts shall be selected based on the application from the control wiring diagrams or the functional description. Where timing relays and control relays require additional contacts, provide auxiliary control relays properly sized for the application.

All contacts and relays shall be NEMA rated and UL recognized.

The electrical life expectancy for the relay shall be over 500,000 operations at 120V AC, 10 amp; (over 200,000 operations at 120V AC, 10 amp for SPDT, 3PDT, and 4PDT). The mechanical life expectancy for the relay shall be over 50,000,000 operations.

16.32.1 Control Relays

Manufacturers

- Square D Class 8501, Type K or R
- Allen Bradley 700 Type HA or HB
- IDEC RH Series; or equal

Manufactured Units

Relays for general purpose use shall be DPDT or 3PDT, 10-amp contacts with the appropriate coil voltage for the application. Relays shall be plug-in type with matching socket. All relays shall have LED indicators to signal when the coil is energized. Relay coils shall be rated for continuous duty.

16.32.3 Time Delay Relays

Manufacturers

- Allen-Bradley 700 Type HR
- IDEC GE1, RTE or GT3 Series; or equal

Manufactured Units

Time delay relays shall be multi-function, multi-range with plug-in base, pin style terminations timing and timed out LED indicators, and calibrated scales. Relays shall have minimum 0.5 seconds to 60 minutes, 8 selectable timing ranges, 5-amp contacts. Select coil voltage for the application. Units shall be sealed to prevent entry of contamination in the form of dust, dirt, or moisture.

Appropriate relay shall be selected based on application from the control wiring diagrams.

Minimum accuracy (plus or minus) shall be as follows:

1. Repeat accuracy – ½ percent.
2. Timing change over full voltage range – ½ percent change over full temperature range.
3. Scale tolerance – 5-percent.

16.35 Control Panel Accessories

16.35.1 Terminal Blocks

Part 2 – Products

Manufactured Units

Terminal blocks shall be one-piece, molded, plastic blocks with screw-type terminals and barriers rated for 600 volts. Terminals shall be double-sided and supplied with removable covers to prevent accidental contact with live circuits. Terminals shall have permanent, legible identification, clearly visible with the protection cover removed.

Part 3 – Execution

Installation

All wires between panel-mounted equipment and other equipment shall be terminated at terminal blocks. Switches shall be terminated at the terminal blocks with crimp-type, pre-insulated, ring-tongue lugs. Lugs shall be of the appropriate size for their terminal block screws and for the number and size of the wires terminated. All wires shall be labeled with the circuit number and common function.

16.35.2 Nameplates

Part 2 – Products

Manufactured Units

Standard nameplates shall be made of $^{1}/_{16}$-inch thick machine engraved laminated phenolic having black letters not less than $^{3}/_{16}$-inch high on white background. One-inch high lettering shall be used for the large nameplates required for the control panels and motor control centers.

Part 3 – Execution

Installation

Nameplates shall be provided on all electrical devices including but not limited to motor control equipment, MCC cubicles, control stations, junction boxes, panels, motors, instruments, switches, indicating lights, meters, and all electrical equipment enclosures. Each motor control center compartment and control panel shall have a nameplate designating the equipment and its identifying number and size or rating. Data shall be as shown on the Plans and reviewed via the submittal process. Nameplates shall have name, number and/or function as is applicable for clear identification.

Provide one large nameplate for each motor control center and/or control panel identifying the equipment as indicated on the Plans.

Nameplates on steel panels shall be secured with stainless steel drive screws. Where it is proposed that nameplates will be secured with pressure sensitive tape or bonding cement, the process and samples shall be submitted to the Engineer for acceptance.

Nameplates shall be provided for identifying all operator interface (lights, switches, etc.) and other devices that are located outside or inside the panels.

Nameplates shall be provided for identifying all relays and devices that are located inside the panels.

Special Functions

Provide warning nameplates on all panels and equipment, which contain multiple power sources. Lettering shall be white on red background.

16.40 LOW VOLTAGE MOTOR CONTROL EQUIPMENT

16.45 Variable Frequency Drive

Part 1 - General

Summary

The Variable Frequency Drive (VFD) system shall contain all components required to meet the performance, protection, safety, and certification criteria of this specification.

Related Sections

- Division 10.14 Signage
- Division 16.30 Basic Panel Equipment and Devices
- Division 17 Automatic Control

References

- National Fire Protection Association - NFPA 70 - US National Electrical Code.
- National Electrical Manufacturers Association - NEMA 250 - Enclosures for Electrical Equipment.
- Underwriters Laboratory Inc. – UL 508.
- Canadian Standards Association International – CAN/CSA-C22.2 No. 14-05.
- International Electrical Code - IEC 146.
- Institute of Electrical and Electronics Engineers, Inc. - IEEE 519 - IEEE Standard Practices and Requirements for Harmonic Control in Electrical Power Systems.
- Seismic Standards ASCE 7-10, IBC, CBC, ICC_ESAC156, IEEE 693 and California OSHPD.

Submittals

Submit under provisions of Sections 1.33 and 16.05.

Shop Drawings - Approval

1. Elevation Drawings: Include dimensional information and conduit routing locations.
2. Unit Descriptions: Include amperage ratings, enclosure ratings, fault ratings, nameplate information, and so on, as required for approval.
3. Wiring Diagrams:
    a) Power Diagram: Include amperage ratings, circuit breaker frame sizes, circuit breaker continuous amp ratings, and so on, as required for approval.
    b) Control Diagram: Include disconnect devices, pilot devices, and so on.
4. Major components list.

Product Data Sheets

1. VFD and Operator Interface publications.
2. Data sheets and publications on all major components including, but not limited to, the following:
    a) Contactors
    b) Circuit breaker and fuse (power and control)
    c) Control power transformers
    d) Pilot devices
    e) Relays/Timers

Test procedures shall be per the manufacturer's standards.

Closeout Submittals (Operation and Maintenance Manuals)

Submit under provisions of Sections 1.79.2 and 17.94.

Shop Drawings – Final as shipped

1. Elevation Drawings: Include dimensional information and conduit routing locations.
2. Unit Descriptions: Include amperage ratings, enclosure ratings, fault ratings, nameplate information, and so on, as required for approval.
3. Wiring Diagrams:
    a) Power Diagram: Include amperage ratings, circuit breaker frame sizes, circuit breaker continuous amp ratings, and so on, as required for approval.
    b) Control Diagram: Include disconnect devices, pilot devices, and so on.
    c) Diagrams shall updated based on field modifications and shall be accurate depicting point-to-point wiring.
4. Major components list.

Product Data Sheets

1. VFD and Operator Interface publications.
2. Data sheets and publications on all major components including, but not limited to, the following:
    a) Contactors
    b) Circuit breaker and fuse (power and control)
    c) Control power transformers
    d) Pilot devices
    e) Relays/Timers

Test procedures shall be per the manufacturer's standards.

Operation and Maintenance Data

1. Service and Contact information
2. VFD and Operator Interface User Manuals
3. Troubleshooting / Service Manuals

Quality Assurance

Qualifications:

1. Manufacturers:
   a) The VFD and all associated optional equipment shall be UL listed or recognized.
   b) The VFD shall contain a UL label attached on the inside of the enclosure cabinet.
2. Suppliers:
   a) All inspection and testing procedures shall be developed and controlled under the guidelines of the Supplier's quality system and must be registered to ISO 9001 and regularly reviewed and audited by a third-party registrar.
   b) The VFD shall be factory pre-wired, assembled and tested as a complete package.
   c) The packaged VFD system shall be supplied by the Control System Integrator, preselected by the Owner. See Division 17 for details.

Delivery, Storage, and Handling

Contractor shall coordinate the shipping of equipment with the manufacturer.

Contactor shall store the equipment in a clean and dry space at an ambient temperature range of -25 degrees Celsius to 55 degrees Celsius (-13 degrees Fahrenheit to 130 degrees Fahrenheit).

The Contractor shall protect the units from dirt, water, construction debris, and traffic.

Design Requirements

Drive(s) shall be of the size, capacity and quantity as shown on the Plans. VFD supplier shall confirm motor HP, amperage, service factor and operating requirements with motor supplier.

The VFD motor controller shall convert 480 Volt, 3-phase, 60 Hertz utility power to adjustable voltage (0 - 460V) and frequency (0 - 60 Hz.) 3-phase, AC power for stepless motor speed control with a capability of 10:1 speed range. All general options and modifications shall mount within the standard adjustable frequency controller enclosure.

The controller(s) shall be suitable for use with any standard NEMA-B squirrel-cage induction motor(s) having a 1.15 Service factor. At any time in the future, it shall be possible to substitute any standard motor (equivalent horsepower, voltage, and current) in the field.

The variable frequency control shall operate satisfactorily when connected to a bus supplying other solid-state power conversion equipment which may be causing up to 10 percent total harmonic voltage distortion and commutation notches up to 36,500-volt microseconds, or when other VFDs are operated from the same bus. Manufacturers shall certify at submittal time that their equipment will function satisfactorily under these circumstances.

Individual or simultaneous operation of the VFDs shall not add more than 5 percent total harmonic current distortion to the normal bus, nor more than 10 percent while operating from standby generator per IEEE 519, 2014. Prior to project completion, the Contractor shall provide verification through both measurement and calculations that the system is compliant with IEEE 519, 2014.

VFDs may be variable torque or constant torque rated depending on the motor being operated. The VFD supplier shall review the appropriate Division 11 specifications coordinate with the equipment manufacturer of the motor being operated to ensure that the VFD supplied has a torque rating compatible with the motor.

VFDs for Progressive Cavity Pumps shall capable of 150 percent of full load amps as a starting torque.

Part 2 – Products

Manufacturers

The VFD shall be an Allen-Bradley Powerflex 755TS model VFD with EtherNet/IP communication interface or pre-approved equal. All drives shall be supplied by one manufacturer.

Manufactured Units

The variable frequency control shall include transient voltage suppression to allow reliable operation on a typical industrial or commercial power distribution system.

Hardware

1. Utilize diode bridge or SCR bridge on the input rectifier.
2. Utilize DC bus inductor on all six-pulse VFDs only.
3. Utilize switching logic power supply operating from the DC bus.
4. Incorporate phase to phase and phase to ground MOV protection on the AC input line.
5. Microprocessor based inverter logic shall be isolated from power circuits.
6. Utilize latest generation IGBT inverter section.
7. Battery receptacle for Lithium battery power to the Real Time Clock.
8. Additional DPI port for handheld and remote HIM options.
9. Dedicated Digital Input for hardware enable.
10. Conformal coated printed circular boards.
11. Informal coated printed circuit boards.
12. Optional onboard 24V DC Auxiliary Control Power Supply.
13. The drive shall have the following specific features to enable integration with a Rockwell Automation ControlLogix™ or CompactLogix™ Automation Controller.
    a) Shall have Add on Profile available for use with Rockwell Automation Studio 5000 programming software.

b) Shall support Rockwell Automation controller's Automatic Device Configuration functionality.

Control Logic

1. Ability to operate with motor disconnected when in V/Hz mode.
2. Provide a controlled shut down, when properly protected, with no component failure in the event of an output phase to phase or phase to ground short circuit. Provide annunciation of the fault condition.
3. Provide multiple programmable stop modes including Ramp, Coast, DC-Brake, Ramp-to-Hold, Fast Braking, and Current Limit Stop.
4. Provide multiple acceleration and deceleration rates.
5. Adjustable output frequency up to 650 Hz.
6. Ability to control outputs and manage status information locally within the VFD.
7. Ability to function stand-alone or complementary to supervisory control.
8. Ability to provide scaling, selector switches, or other data manipulations not already built into the VFD.

Motor Control Modes

1. Selectable Sensorless Vector, Flux Vector, V/Hz, and Adjustable Voltage Control modes selectable through programming.
2. The drive shall be supplied with a Start-up and Auto-tune mode.
3. The V/Hz mode shall be programmable for fan curve or full custom patterns.
4. Capable of Open Loop V/Hz.

Current Limit

1. Programmable current limit from 20 percent to 160 percent of rated output current.
2. Current limit shall be active for all drive states: accelerating, constant speed and decelerating.
3. The drive shall employ PI regulation with an adjustable gain for smooth transition in and out of current limit.

Acceleration / Deceleration

1. Accel/Decel settings shall provide separate adjustments to allow either setting to be adjusted from 0 to 3600 seconds.
2. A second set of remotely selectable accel/decel settings shall be accessible through digital inputs.
3. S Curve profiles shall be adjustable.

Adjustments

1. A digital interface can be used for all set-up, operation and adjustment settings.

2. All adjustments shall be stored in nonvolatile memory (EEPROM).
3. No potentiometer adjustments shall be required.
4. EEPROM memory for factory default values shall be provided.
5. Software must be available for trending and diagnostics, as well as online and offline programming functionality.

Process PID Control

1. The drive shall incorporate an internal process PI regulator with proportional and integral gain adjustments as well as error inversion and output clamping functions.
2. The feedback shall be configurable for normal or square root functions. If the feedback indicates that the process is moving away from the set-point, the regulator shall adjust the drive output until the feedback equals the reference.
3. Process control shall be capable of being enabled or disabled with a hardwire input. Transitioning in and out of process control shall be capable of being tuned for faster response by preloading the integrator.
4. Protection shall be provided for a loss of feedback or reference signal.

Skip Frequencies

1. Three adjustable set points that lock out continuous operation at frequencies which may produce mechanical resonance shall be provided.
2. The set points shall have a bandwidth adjustable from Maximum Reverse Speed to Maximum Forward Speed.

Fault Memory

1. The last 100 fault codes shall be stored and time stamped in a fault buffer.
2. Information about the drive's condition at the time of the last fault such as operating frequency, output current, dc bus voltage and twenty-seven other status conditions shall be stored.
3. A power-up marker shall be provided at each power-up time to aid in analyzing fault data.
4. The last 100 alarm codes shall be stored and time stamped for additional troubleshooting reference.

Fault Reset / Run

1. The drive shall provide up to nine automatic fault reset and restarts following a fault condition before locking out and requiring manual restart.
2. The automatic mode shall not be applicable to a ground fault, shorted output faults and other internal microprocessor faults.
3. The time between restarts shall be adjustable from 0.5 seconds to 30 seconds.

Run on Power Up

1. A user programmable restart function shall be provided to allow restart of the equipment after restoration of power after long duration power outages. Restart time dependent on presence of incoming signal.

Overload Protection

1. The drive shall provide internal class 10 adjustable overload protection.
2. Overload protection shall be speed sensitive and adjustable.
3. A viewable parameter shall store the overload usage.

Auto Economizer

1. An auto economizer feature shall be available to automatically reduce the output voltage when the drive is operating in an idle mode (drive output current less than programmed motor FLA). The voltage shall be reduced to minimize flux current in a lightly loaded motor thus reducing kW usage.
2. When the load increases, the drive shall automatically return to normal operation.

Terminal Blocks

1. Separate terminal blocks shall be provided for control and power wiring.
2. I/O terminal blocks shall be removable with wiring in place.
3. For frames 8 to 10 power wiring is landed on robust L-brackets behind the drive unit. This wiring remains in-place if the drive unit is removed.

Flying Start

1. The drive shall be capable of determining the speed and direction of a spinning motor and adjust its output to "pick-up" the motor at the rotating speed. This feature is disabled by default.

Inputs and Outputs

1. The Input / Output option modules shall consist of both analog and digital I/O.
2. No jumpers or switches shall be required to configure digital inputs and outputs.
3. All digital input and output functions shall be fully programmable.
4. The control terminal blocks shall be rated for 115V AC.
5. Inputs shall be optically isolated from the drive control logic.
6. The control interface card shall provide input terminals for access to fixed drive functions that include start, stop, external fault, speed, and enable.

7. The VFD shall be capable of supporting up to 7 analog inputs, 7 analog outputs, 21 digital inputs, 7 relay outputs, 7 transistor outputs, and 3 positive temperature coefficient (PTC) inputs.
8. The Input / Output option modules shall have the following features:
    a) Analog Inputs:
        i. Quantity two (2) differentially isolated, ±10V (bi-polar), 88k ohm input impedance, 4-20 mA, 11 bit plus sign.
        ii. Analog inputs shall be user programmable for a variety of uses including frequency command and process loop input. Analog inputs shall be user programmable for function scaling (including invert), offset, signal loss detect, and square root.
    b) Analog Outputs:
        i. Quantity two (2) ±10V (bi-polar) / 11 bit and sign, 2 k ohm minimum load, 4-20 mA, 11 bit plus sign, 400 ohm maximum load.
        ii. The analog output shall be user programmable to be proportional to one of fourteen process parameters including output frequency, output current, encoder feedback, output power.
        iii. Programming shall be available to select either absolute or signed values of these parameters.
    c) Digital Inputs:
        i. Quantity of six (6) digital inputs rated 24V DC/115V AC.
        ii. All inputs shall be individually programmable for multiple functions including: Start, Run, Stop, Auxiliary Fault, Speed Select, Jog and Process PI functions.
    d) Digital Outputs:
        i. At least one (1) relay output (N.O. or N.C.).
        ii. For 240V AC or 24V DC, N.O. contact output ratings shall be 2-amp maximum, general purpose (inductive)/resistive. N.C. contact output ratings shall be 2-amp maximum, resistive only.
        iii. Relays shall be programmable to multiple conditions including: Fault, Alarm, At Speed, Drive Ready, and PI Excess Error.
        iv. Timers shall be available for each output to control the amount of time, after the occurring event, that the output relay actually changes state.
        v. At least one (1) transistor output.
        vi. For 24V DC, transistor output rating shall be 1-amp maximum, Resistive.

<u>Reference Signals</u>

1. The drive shall be capable of using the following input reference signals:
    a) Analog Inputs
    b) Preset Speeds

c) Remote Potentiometer

d) Digital MOP

e) Human Interface Module

f) Communication Modules

Loss of Reference

1. The drive shall be capable of sensing reference loss conditions.
2. In the event of loss of the reference signal, the drive shall be user programmable to the following:
   a) Fault the drive and coast to stop.
   b) Issue a minor fault - allows the drive to continue running while some types of faults are present.
   c) Alarm and maintain last reference.
3. When using a communications network to control the drive, the communications adapter shall have these configurable responses to network disruptions and controller idle (fault or program) conditions:
   a) Fault
   b) Stop
   c) Zero Data
   d) Hold Last State
   e) Send Fault Configuration

Metering

1. At a minimum, the following parameters shall be accessible through the Human Interface Module, if installed:
   a) Output Current in Amps
   b) Output Voltage in Volts
   c) Output Power in kW
   d) Elapsed MWh
   e) DC Bus Voltage
   f) Frequency
   g) Heatsink Temperature
   h) Last eight (32) faults
   i) Elapsed Run Time
   j) IGBT Temperature
   k) Blown fuses, including specific fuse locations communicated to the host system

Faults

1. At a minimum, the following faults shall be accessible through the Human Interface Module:
   a) Power Loss
   b) Undervoltage
   c) Overvoltage
   d) Motor Overload
   e) Heat Sink Over-temperature
   f) Maximum Retries
   g) Phase to Phase and Phase to Ground Faults

Predictive Maintenance Features

1. At a minimum, the following predictive diagnostic features shall be provided, and a parameter showing the remaining lifetime expressed as hours of the following components will be available:
   a) Relay Output Life Cycles based on load type and amps.
   b) Hours of Fan Life based on load and ambient temperature.
   c) Motor Bearing life based on expected hours of use.
   d) Motor Lubrication schedule based on hours of use.
   e) Machine Bearing life based on expected hours of use.
   f) DC Bus Capacitors based on actual use (temperature, current, and ripple).
   g) IGBTs based on actual load and temperature.
   h) LCL filter Capacitors based on actual use.

Real-Time Clock

1. Shall be capable of providing time stamped events.
2. Shall have the ability to be set locally or via a remote controller.
3. Shall provide the ability to be programmable for month, day, year and local time zones in HH:MM:SS.

VFD Packaged System

Basic Features

1. Ratings
   a) Voltage
      i. Capable of accepting nominal power of 480V AC at 60 Hz.
      ii. The supply input voltage tolerance shall be ± 10 percent of nominal line voltage.

b) Displacement Power Factor

i. Six-pulse VFD shall be capable of maintaining a minimum true power factor (Displacement P.F. X Distortion P.F.) of 0.95 or better at rated load and nominal line voltage, over the entire speed range.

c) Efficiency

i. A minimum of 96.5 percent (+/- 1 percent) at 100 percent speed and 100 percent motor load at nominal line voltage.

ii. Control power supplies, control circuits, and cooling fans shall be included in all loss calculations.

d) Operating ambient temperature range without derating: 0 degrees Celsius to 40 degrees Celsius (32 degrees Fahrenheit to 104 degrees Fahrenheit).

e) Operating relative humidity range shall be 5 percent to 95 percent non-condensing.

f) Operating elevation shall be up to 1,000 Meters (3,300 ft) without derating.

2. Sizing

a) Systems rated at Normal Duty loads shall provide 110 percent overload capability for up to one minute and 150 percent for up to 3 seconds.

b) Systems rated at Heavy Duty loads shall provide 150 percent overload capability for up to one minute and 180 percent for up to 3 seconds.

3. Auto Reset/Run

a) For faults other than those caused by a loss of power or any other non-critical fault, the drive system shall provide a means to automatically clear the fault and resume operation.

4. Ride-Through

a) The VFD system shall attempt to ride through power dips up to 20 percent of nominal. The duration of ride-through shall be inversely proportional to load. For outages greater than 20 percent, the drive shall stop the motor and issue a power loss alarm signal to a process controller, which may be forwarded to an external alarm signaling device.

5. Run on Power Up

a) The VFD system shall provide circuitry to allow for remote restart of equipment after a power outage. Unless indicated in the contact drawings, faults due to power outages shall be remotely resettable. The VFD system shall indicate a loss of power to a process controller, which may be forwarded to an external alarm signaling device. Upon indication of power restoration the process controller will attempt to clear any faults and issue a run command, if desired.

6. Communications

a) VFD shall be capable of communicating on multiple networks.

b) The VFD shall provide a Dual Port EtherNet/IP interface.

c) VFD shall be capable of supporting the following network options:

i. EtherNet/IP

7. Enclosure Door Mounted Human Interface Module (HIM)

a) VFD shall provide a HIM with integral LCD display, operating keys and programming keys.

b) An enclosure door-mounted HIM, rated NEMA/UL Type 4/12, shall be provided.

c) The HIM shall have the following features:

i. A seven (7) line by twenty-one (21) character backlit LCD display with graphics capability.

ii. Shall indicate drive operating conditions, adjustments, and fault indications.

iii. Shall be configured to display in the following three distinct zones:

a. The top zone shall display the status of direction, drive condition, fault / alarm conditions, and Auto / Manual mode.

b. The middle zone shall display drive output frequency.

c. The bottom zone shall be configurable as a display for either programming menus / information or as a two-line user display for two additional values utilizing scaled units.

iv. Shall provide digital speed control.

v. The keypad shall include programming keys, drive operating keys (Start, Stop, Direction, Jog, and Speed Control), and numeric keys for direct entry.

Enclosure

1. Shall be rated NEMA/UL Type 12.
2. Shall be painted per the manufacturer's standard.
3. Shall provide entry and exit locations for power cables.
4. Shall contain a label for UL508.
5. The drive system nameplate shall be marked with system Short Circuit Current Rating (SCCR).

Drive Enclosure Input Disconnect

1. Provide an enclosure door interlocked disconnect with a thermal magnet circuit breaker.
2. Operator Handles

a) Provide externally operated main disconnect handle.

b) Handles shall be lockable with up to three lockout / tagout padlock positions.

Branch Circuit Protection

1. Input fusing and inverse time circuit breaker shall be provided.

Control Power Transformer

1. Provide a control power transformer mounted and wired inside of the drive system enclosure.
2. The transformer shall be rated for the VFD power requirements.

Harmonic Mitigation Techniques

1. The drive system shall be compliant with IEEE 519-2014 standards at the input VFD terminals based upon the input power phase imbalance within 0.5 percent of nominal line voltage and under full VFD output current ratings
2. Passive Harmonic Filter
    a) VFDs shown with passive harmonic line filters shall be supplied with an input AC line harmonic filter compensated reactor with minimum 5 percent impedance unless noted otherwise on the one-line diagram. Line reactor shall be designed to address performance issues of NEMA MG1-20.55 and to provide proper transient protection of the VFD input power devices. Harmonic line filters shall be MTE Matrix Series AP Harmonic Filters or equal, with Capacitor Contactor for disconnecting the filter capacitor bank when the drive is not running.

Control Interface

1. The control terminals shall be rated for 115V AC.
2. The control interface shall provide input terminals for access to VFD functions that include start, stop, external fault, speed select, and enable, as required.

Hand/Off/Auto Selector Switch

1. Provide a "HAND/OFF/AUTO" selector switch, mounted on the enclosure door.
2. The "HAND/OFF/AUTO" selector switch shall start the drive in the “HAND” mode and stop the drive in the “OFF” mode.
3. In the “AUTO” mode the drive shall be started and stopped from a remote “RUN” contact.
4. In all modes, Auxiliary and Enable inputs to the drive control interface board must be present before the drive will start.
5. When a HIM is present, the stop function shall always be available to stop the drive regardless of the selected mode (“HAND” or “AUTO”). The HIM will be non-functional (except for the display and programming) when the switch is in “OFF” mode. The HIM shall stop the drive if the switch is in the “AUTO” mode with the remote start contact initiated.
6. The drive speed reference shall be controlled from the HIM, unless a separate door-mounted potentiometer is provided, when in “HAND” mode (factory default setting).
7. The drive speed reference shall be controlled by a remote 4…20 mA input when in “AUTO” mode.
8. See section 16.31.5 Selector Switch.

Drive Disable Mushroom Push Button

1. Provide a maintained mushroom style push button, mounted on the enclosure door that when pushed, will open the drive enable input.
2. See section 16.31.4 Pushbuttons.

Pilot Lights

1. Provide LED pilot lights, mounted on the enclosure door, for indication of the following status:
   a) Run
   b) Drive Fault
   c) Emergency Stop
2. See section 16.31.6 Indicating Lights.

Motor Run Time Meter

1. Provide a digital, non-resettable, door-mounted elapsed time meter.
2. The meter shall be electrically interlocked with the Drive Run relay and Bypass contactor to indicate actual motor operating hours.
3. See section 16.31.2 Run Time Meters.

Part 3 – Execution

Setup

VFD Manufacturer shall program:

1. All fault settings to reset after fault condition returns to normal
2. Minimum and maximum motor speeds provided by motor manufacturer.
3. Hertz change per second.
4. Hand speed control shall be set to 95 percent of full range for panel mounted HOA switch.
5. EtherNet/IP and HIM module communication faults/alarms to "No Action". Communication errors should not shut down the VFD.
6. Parameter 150 (Digital In Cfg) to "Run Level", not "Run Edge".
7. Parameter 292 and I/O card parameters 106 and 116 (Life Event Parameter Settings) to "No Action" so that these life event alarms do not fault the VFD.

VFD Supplier shall provide documentation on how to control the drive over EtherNet/IP. This information should include a unique list of parameter, relay, setpoint, input/output, and control addressing as shown on the Plans and detailed in these specifications. A generic list does not meet this requirement. An Add-on-instruction or profile compatible with Rockwell Automation Studio 5000 programming would meet this requirement.

Examination

Verify that location is ready to receive equipment.

Verify that the building environment can be maintained within the service conditions required by the manufacturer of the VFD.

Testing

This equipment shall be tested and placed into operation by a qualified manufacturer representative trained in start-up and troubleshooting procedures for equipment being installed.

All components shall be factory tested both by the manufacturer at the manufacturer's facility and in the presence of the Engineer by the manufacturer or manufacturer's representative at the manufacturer's facility. Factory testing shall be witnessed by the Engineer. The manufacturer's facility where testing takes place shall be located within the United States of America. Shipment of VFD to the job site shall not be allowed until the Engineer has witnessed factory testing and approved the VFD for shipment to the job site.

Installation

Installation shall be in compliance with all manufacturer requirements, instructions, and drawings.

Startup

At a minimum, the start-up service shall include:

1. Perform pre-Power Check
2. Megger Motor Resistances: Phase-to-Phase and Phase-to-Ground
3. Verify system grounding per manufacturer's specifications
4. Verify power and signal grounds
5. Check connections
6. Check environment

Drive Power-up and Commissioning:

1. Measure Incoming Power Phase-to-Phase and Phase-to-Ground
2. Measure DC Bus Voltage
3. Measure AC Current Unloaded and Loaded
4. Measure Output Voltage Phase-to-Phase and Phase-to-Ground
5. Verify input reference signal

All measurements shall be recorded.

Drive shall be tuned for system operation.

Drive parameter listing shall be provided.

The line side converter shall be configured and tuned for the local input power conditions.

The motor side inverter shall be tuned for system operation.

Training

Manufacturer to provide a quantity of one 4-hour sessions of on-site instruction.

The instruction shall include the operational and maintenance requirements of the variable frequency drive.

The basis of the training shall be the variable frequency drive, the engineered drawings and the user manual. At a minimum, the training shall:

1. Review the engineered drawings identifying the components shown on the drawings.
2. Review starting / stopping and speed control options for the controller.
3. Review operation of the HIM for programming and monitoring of the variable frequency drive.
4. Review the maintenance requirements of the variable frequency drive.
5. Review safety concerns with operating the variable frequency drive.

16.55 SWITCHES AND PROTECTIVE DEVICES

16.55.1 Common Work for Switches and Protective Devices

Part 1 - General

Design Requirements

Overcurrent devices shall be NEMA rated.

Extra Materials

Provide one fuse for each ungrounded conductor and a minimum of one spare fuse per phase of each ampacity and voltage used on the project. Deliver fuses to Owner at the completion of the project.

Part 3 – Execution

Installation

Overcurrent protection devices and safety switches shall be centered 60 inches above the finished floor unless noted otherwise on the Plans.

16.55.13 Fuses

Part 1 - General

Design Requirements

Fuses shall be of the type and amperage indicated on the Plans. The voltage rating shall be appropriate for the application indicated. The fuse types indicated on the Plans imply a certain set of fuse characteristics. No substitutions of fuse types will be allowed without Engineer approval.

Part 2 - Products

Manufacturers

Fuses shall be:

- Bussman,
- Gould Shawmut
- Littlefuse
- Reliance
- Or Equal

Materials

Fuses in motor circuits which are indicated but not sized, shall be provided with Manufacturer's recommended size based on the actual motor installed. In-line or integrally-mounted fuse clips shall be provided on all control power or low-voltage transformers.

16.55.16 Molded Case Circuit Breakers

Part 1 - General

Design Requirements

Breakers shall have the interrupting rating and trip rating indicated on the Plans. All breakers shall be calibrated for operation in an ambient temperature of 40 degrees Celsius.

Part 2 - Products

Manufactured Units

Molded case circuit breakers shall be quick-make and quick-break type with wiping type contacts. Each breaker shall be provided with arc chutes and individual trip mechanisms on each pole consisting of both thermal and magnetic trip elements. Two and three pole breakers shall be common trip. Molded case circuit breakers shall be trip-free. Each breaker shall have trip indication independent of the "ON" or "OFF" positions.

16.60 CONDUCTORS

16.61 Low Voltage Wire and Cable

Part 1 - General

Design Requirements

This section is for power and control conductors for 600 volts or less.

All conductors shall be copper. Wire or cable not shown on the Plans or specified, but required, shall be of the type and size required for the application and in conformance with the applicable code.

Part 2 - Products

Materials

Conductors

1. Solid and stranded copper wire shall be 600-volt Type THW, THWN, or THHW, Class B stranding, sizes #14 AWG, #12 AWG, and #10 AWG only. Use of THHN insulation shall not be allowed. Aluminum conductors shall not be allowed.
2. Stranded copper wire shall be 600-volt Type XHHW, Class B stranding, sizes #8 AWG and larger. Aluminum conductors shall not be allowed.

Splices

1. For Lighting Systems and Power Outlets: Wire nuts shall be twist-on type insulated connectors utilizing an outer insulating cover and a means for connecting and holding the conductors firmly.
2. All Equipment: Crimp type connectors shall be insulated type, suitable for the size and material of the wires and the number of wires to be spliced and for use with either solid or stranded conductors.
3. Division 16 Equipment and Power Conductors: Bolted pressure connectors shall be suitable for the size and material of the conductors to be spliced.
4. All Equipment: Epoxy splice kits shall include epoxy resin, hardener, mold, and shall be suitable for use in wet and hazardous locations.

Terminations

1. Crimp type terminals shall be self-insulating sleeve type, with ring or rectangular type tongue, suitable for the size and material of the wire to be terminated, and for use with either solid or stranded conductors.
2. Terminal lugs shall be split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor.
3. Wire Markers shall be plastic sleeve type. Wire numbers shall be permanently imprinted on the markers.

Finishes

Color Coding: Provide color coding for all circuit conductors. Insulation color shall be white for neutrals and green for grounding conductors. An isolated ground conductor shall be identified with an orange tracer in the green body. Ungrounded conductor colors shall be as follows:

1. 120/208 Volt, 3 Phase: Red, black and blue.
2. 277/480 Volt, 3 Phase: Yellow, brown and orange.
3. 120/240 Volt, 1 Phase: Red and black.

Part 3 – Execution

Location (Installment) Schedule

Provide the following conductors for the following applications:

1. Use stranded copper conductors for all power and control circuits unless noted otherwise on plans or below. Size as noted on the Plans.
2. Contractor may use solid copper conductors for lighting and receptacle circuits using screw-type terminals. Size as noted on the Plans.
3. Size #14 AWG wire or smaller shall not be allowed on power circuits.

Installation

Conductor Splices

1. Splices: Install all conductors without splices unless necessary for installation, as determined by the Engineer. Splices when permitted shall be completed using an approved splice kit intended for the type of conductor and the application. The splice shall be in accordance with the splice kit manufacturer's instructions.
2. Underground Splices: All underground outdoor splices when approved by Engineer shall be completed in an accessible pullbox or handhole using an approved watertight epoxy resin splice kit rated for the application up to 600 volts. Splices will not be allowed to be direct buried.

Conductor Identification

1. Except for interior lighting and receptacle circuits, identify each wire or cable at each termination and in each pullbox, junction box, handhole, and manhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule as favorably by the Engineer.
2. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

Testing

Insulation Resistance Tests: For all circuits 150 volts to ground or more and for all motor circuits over ½ horsepower, test cables per NETA Paragraph 7.3.1. The insulation resistance shall be 20 megohms or more. Submit results to Engineer for review.

16.63 Signal Cable

Part 2 - Products

Materials

Twisted Shielded Pairs (TSP)

1. Cable shall conform to IEEE 383, UL 13, and UL 83 and shall be type PLTC cable suitable for direct burial. Each TSP shall consist of two #16 AWG, 7-strand copper conductors per ASTM B8 with 15 Mils PVC insulation and individual conductor jacket of nylon. Conductors shall be twisted with 2-inch or shorter lay, with 100 percent foil shielding and tinned copper drain wires. The cable shall have an overall PVC jacket with a thickness of 35 Mils. The insulation system shall be rated at 90 degrees Celsius and for operation at 600 volts.

Cat 5E Ethernet Cable

1. The Ethernet cable shall be shielded 600V UL rated. The use of a 300V rated cable is not acceptable. All Ethernet cable terminating outside of a telemetry panel shall be grounded at the telemetry panel only.
2. Ethernet cables shall be industrial type Ethernet cable and UL listed for installation in the Motor Control Center. Ethernet cables shall be Allen-Bradley Ethernet Cable with metal In-cabinet RJ45 Connectors, no substitutions.

Part 3 - Execution

Installation

Cable Installation

1. Cables shall be continuous from initiation to termination without splices.
2. Cable shielding shall be grounded at one end of the cable only. Bonding shall be to a single ground point only. Bonding from cable to cable in multiple run installations shall not be permitted.
3. Install instrumentation cables in separate raceway systems with voltages not to exceed 30 volts DC.

Conductor Identification

1. Except for interior lighting and receptacle circuits, identify each wire or cable at each termination and in each pullbox, junction box, handhole, and manhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule as determined by the Engineer.

2. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

Testing

Insulation Resistance Tests: Perform insulation resistance on all circuits. Make these tests before any equipment has been connected. Test the insulation with a 500 Vdc insulation resistance tester with a scale reading 100 mega ohms. The insulation resistance shall be 20 mega ohms or more. Submit results to Engineer for review.

16.70 RACEWAYS, BOXES, AND FITTINGS

16.71 Raceways

Part 1 – General

Design Requirements

Conduit sizes not noted on Plans shall be in accordance with NEC requirements for the quantities and sizes of wire installed therein.

Grounding of the raceway, junction boxes, fittings and any other boxes is the responsibility of the Contractor. Ground conductors, bushings, connections, clamps and other materials as needed to ground the raceway system is the responsibility of the Contractor. All raceways shall be grounded in accordance with the NEC.

Part 2 – Products

Components

Conduit and Fittings

1. Galvanized Rigid Steel (GRS): Rigid conduit shall be steel, hot dipped galvanized inside and out. The GRS must meet USA Standards Institute C80-1 Underwriters Laboratories Standard UL6 and carry a UL label. Use cast threaded hub fittings and junction boxes for all rigid conduit except in locations not permitted by the NEC.
2. PVC Coated Rigid Steel Conduit (PVC-GRS): PVC coated conduit shall meet the GRS standard above plus have a 40 Mil PVC factory applied PVC coating.
3. Nonmetallic Conduit: Nonmetallic Conduit shall be rigid PVC, Schedule 40 (PVC-40) or 80 (PVC-80). PVC conduit installed above grade shall be Schedule 80 extra heavy wall 90 degree Celsius. UL listed for aboveground use and UV resistant. Conduit shall be gray in color. Fittings shall be of the same material as the raceway and installed with solvent per the Manufacturer's instructions. Conduit, fittings, and solvent shall all be manufactured by the same Manufacturer.
4. Flexible Metal Conduit (Flex-LT): Flexible conduit shall be interlocking single strip, hot dipped galvanized and shall have a polyvinyl chloride jacket extruded over the outside to form a flexible watertight raceway. Flexible conduit shall be American Brass Company Sealtite Type VA, General Electric Type UA or equal.

5. Electrical Metallic Tubing (EMT): EMT shall be UL 797 and ANSI C80.3; steel tubing, hot dipped galvanized. EMT fittings shall be ANSI/NEMA FB 1; steel, rain tight, insulated throat, compression type.

Conduit and Cable Supports

1. Conduit Supports: Hot dipped galvanized framing channel shall be used to support groups of conduit. Individual conduit supports shall be one-hole galvanized malleable iron pipe straps used with galvanized clamp backs and nesting backs where required. Conduit support for PVC or PVC coated rigid steel shall be one-hole PVC or epoxy coated clamps or PVC conduit wall hangers.
2. Ceiling Hangers: Ceiling hangers shall be adjustable galvanized carbon steel rod hangers. Unless otherwise specified, hanger rods shall be ½-inch all-thread rod and shall meet ASTM A193. Hanger rods in corrosive areas and those exposed to weather or moisture shall be stainless steel.

Conduit Sealants

1. Moisture Barrier Types: Sealant shall be a non-toxic, non-shrink, non-hardening, putty type hand applied material providing an effective barrier under submerged conditions.
2. Fire Retardant Types: Fire stop material shall be a reusable, non-toxic, asbestos-free, expanding, putty type material with a 3-hour rating in accordance with UL 1479. Provide products indicated by the manufacturer to be suitable for the type and size of penetration.

Part 3 - Installation

Raceway Applications

Galvanized Rigid Steel (GRS) conduit shall be used in all locations unless noted otherwise below or on the Plans.

ABOVE GRADE CONDUITS (non-corrosive areas) shall be:

1. GRS for power and control wiring.
2. GRS for instrumentation and telecommunications wiring.
3. GRS for motor leads from VFDs.
4. EMT for above-grade lighting circuits.

ABOVE GRADE CONDUITS (wet or corrosive areas, NFPA 70 hazardous areas) shall be:

1. PVC-GRS for power and control wiring.
2. PVC-GRS for instrumentation and telecommunications wiring.
3. PVC-GRS for motor leads from VFDs.

CONCEALED ABOVE GRADE CONDUITS shall be:

1. GRS for all wire and cable types in wood stud frame walls.
2. GRS for power and control wiring in concrete block or brick walls.
3. GRS for instrumentation and telecommunications wiring in CMU or brick walls.

4. GRS for motor leads from VFDs in CMU or brick walls.

ALL CONNECTIONS TO VIBRATING EQUIPMENT OR MOTORS shall be:

1. Liquidtight flexible metallic conduit for indoor, non-corrosive areas and all motor leads from VFDs.
2. Connection to equipment outdoors or in corrosive areas shall be with non-metallic liquidtight flexible conduit (except for motor leads from VFDs shall be flexible metallic.)

Installation

All conduits shall be concealed in the floor, walls, ceiling slab, or beneath the floor slab. Surface mounted conduit will not be accepted unless noted otherwise on the construction Plans.

Size of Raceways:

1. Raceway sizes as shown on the Plans, if not shown on the Plans, then size in accordance with NFPA 70.
2. Unless specifically indicated otherwise, the minimum raceway size shall be:
   a) Conduit: ¾-inch

All raceways shall contain a separate grounding conductor.

Spare conduits shall contain one $^{3}/_{16}$-inch diameter nylon pull rope.

Conduit routing is shown diagrammatic on the Plans. Contractor is responsible for routing the conduits in a neat manner, parallel and perpendicular to walls and ceilings.

Location of conduit ends are shown approximately. Contractor is responsible for ending conduits in location that will not conflict with electrical equipment. Route conduit ends to facilitate ease of equipment maintenance. Conduits extending from the floor to a device shall be located as close as possible to avoid creating a hazard.

Conduit shall not be routed on exterior of structures except as specifically indicated on the Plans.

Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

Securely fasten raceways at intervals and locations required by NEC, or the type of raceway employed.

Provide all required openings in walls, floors and ceilings for conduit penetration.

1. Do not install one (1) inch and larger raceways in or through structural members (beams, slabs, etc.) unless approved by Engineer.
2. New Construction: Avoid cutting openings, where possible, by setting sleeves or frames in masonry and concrete, and by requesting openings in advance.
3. Existing Construction: Core drill openings in masonry and concrete. Avoid structural members and rebar.

Conduit encasement or embedment in the earth shall be separated from the earth by at least 3-inches of concrete unless otherwise shown on the Plans. Plastic conduit spacers shall be located five feet on centers. The spacers shall be secured to the conduits by wire ties. The conduits shall be watertight.

Analog signal conduits shall be separated from power or control conduits. The separation shall be a minimum of 12-inches for metallic conduits and 24-inches for nonmetallic conduits.

Install explosion-proof seal-offs in hazardous areas shown on the Plans and as required by the NEC.

Plastic raceway joints shall be solvent cemented in accordance with recommendations of raceway manufacturer.

All conduit openings not encased in a panel shall be sealed with duct seal.

Wireway Installation

1. Straight sections and fittings shall be solidly bolted together to be mechanically rigid and electrically continuous. Dead ends shall be closed. Unused conduit openings shall be plugged.
2. Wireways shall be supported every 5 feet minimum.

16.72 Boxes and Enclosures

16.72.2 Outlet and Junction Boxes

Part 1 – General

Design Requirements

In corrosive areas, all junction boxes shall be NEMA 4X.

Outlet boxes and switch boxes shall be designed for mounting flush wiring devices.

Outlet boxes shall not be less than 4-inch square and 1½-inch deep. Ceiling boxes shall withstand a vertical force of 200 pounds for five minutes. Wall boxes shall withstand a vertical downward force of 50 pounds for five minutes.

Part 2 – Products

Materials

Use cast boxes with threaded hubs for all rigid and intermediate conduits. Steel boxes may be used with rigid and intermediate conduits where cast boxes are not allowed by the NEC. All boxes shall be of proper size to accommodate devices, connectors, and number of wires present in the box. Boxes shall be readily accessible.

Cast box bodies and cover shall be cast or malleable iron with a minimum wall thickness of ⅛-inch at every point, and not less than ¼-inch at tapped holes for rigid conduit. Bosses are not acceptable. Mounting lugs shall be provided at the back or bottom corners of the body. Covers shall be secured to the box body with No. 6 or larger brass or bronze flathead screws. Boxes shall be provided with neoprene cover gaskets. Outlet boxes shall be of the FS types. Boxes shall conform to FS W-C-586C and UL 514.

Sheet metal boxes shall conform to UL 50, with a hot-dipped galvanized finish conforming to ASTM A123. Boxes and box extension rings shall be provided with knockouts. Boxes shall be formed in one piece from carbon-steel sheets.

Non-metallic boxes shall be hot-compressed fiberglass, one-piece, molded with reinforcing of polyester material, with a minimum wall thickness of ⅛-inch.

Finishes

Where only cast aluminum is available for certain types of fixture boxes, an epoxy finish shall be provided.

16.72.3 Watertight Enclosures

Part 2 – Products

Manufacturers

The watertight enclosure shall be equal to Hoffman.

Materials

Watertight enclosures for vault electrical outlets shall be molded from fiberglass reinforced polyester material. A hinged cover shall be gasketed and opened with quick release latches. The conduit penetrations shall be sealed watertight.

Part 3 – Execution

Installation

An epoxy plug shall be installed in the conduit to prevent the migration of water into the conduit. The enclosure shall be NEMA rated and installed per all applicable codes.

16.95 TESTING

16.95.1 Common Work for Testing

Part 1 - General

Submittals

Test reports shall be submitted to the Engineer prior to final acceptance in accordance with Division 1.33 of these specifications.

Scheduling and Coordination

The Contractor shall inform the Engineer in advance of testing in accordance with the requirements listed in Division 1 of these specifications.

Prior to scheduling the testing, the Contractor shall have satisfied themselves that the project area is properly cleaned up; all patching and painting deemed necessary properly completed; and all systems, equipment and controls are functioning as intended.

Part 2 - Products

Source Quality Control

Submit reports of factory tests and adjustments performed by equipment manufacturers to the Engineer prior to field testing and adjustment of equipment. These reports shall identify the equipment and show dates, results of test, measured values and final adjustment settings. Provide factory tests and adjustments for equipment where factory tests are specified in the equipment specifications. The Engineer may inspect the fabricated equipment at the factory before shipment to job site. Provide the Engineer with sufficient prior notice so that an inspection can be arranged at the factory.

Part 3 – Execution

Site Testing

Test all circuits for continuity, freedom from ground, and proper operation during progress of the work.

Insulation Resistance, Continuity, and Rotation: Perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment prior and in addition to tests performed by the testing laboratory specified herein.

Electric Motors: Perform voltage, current and resistance tests on all motors ½ horsepower and larger installed this project. Insulation resistance readings shall be taken with a 500-volt megger for 30 seconds with the circuit conductors connected to the motor. Verify that an overload condition does not exist.

Conduct special test as required for service and/or system ground.

Arc Flash Study, Protection Device Coordination, and Short Circuit Analysis

Provide the services of a recognized independent testing laboratory or coordination analysis consultant for the proper system coordination of the protective devices furnished on this project. Submit the name and the qualifications of the laboratory or consultant for review by the Engineer; qualifications must include professional registration of proposed personnel as electrical engineers.

The protective device on the line side closest to the fault or abnormal conditions shall isolate the problem portion of the system and minimize damage in that portion. The rest of the system shall be maintained in normal service. The coordination shall be in conformance with the recommendations of latest IEEE Standard 242.

Provide an Arc Flash Hazard Study for the electrical distribution system shown on the Plans. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the one-line diagrams. This includes switchgear, switchboards, panelboards, motor control centers, generators, transfer switches, and transformers. The study will include creation of Arc Flash Hazard Warning Labels listing all items as required in NFPA 70E-2018. These labels serve as a guide to assist technicians and others in the selection of proper Personal Protective Equipment when working around exposed and energized conductors. The electrical contractor will install the labels. The arc flash hazard study shall consider all operating scenarios during normal conditions alternate

operations, emergency power conditions, and any other operations, which could result in maximum arc flash hazard. The label shall list the maximum incidental energy calculated and the scenario number and description on the label.

Submit the analysis that shall include arc flash, impedance, and short circuit calculations, list of any assumptions made and the analysis, the recommended settings of the protective devices, and the system time/current characteristic curves. The submittal shall be completed and submitted in conjunction with the circuit breaker submittal to allow time for review and re-submittal, if necessary, before the implementation of final settings and adjustments by the testing laboratory.

Field Quality Control

General

1. Conduct final test in the presence of Owner and/or their authorized representative. Contractor shall provide all testing instrumentation and labor required to demonstrate satisfactory operation of systems, equipment and controls.

Operational Tests

1. Operational test all circuits to demonstrate that the circuits and equipment have been properly installed, adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, and including alarm conditions, and demonstrate satisfactory interfacing with the data acquisition and alarm systems.

16.95.3 Conductor Test Report

Conductor Test Report Page 1 of 1														
PROJECT:								OWNER:						
Contractor Co. Name: Tested by:								Phone Number: Test Date:						
Race-way Label (1)	V (2)	C (3)	Operating Load Voltage						Insulation Resistance - OHMS					
			VAB	VCB	VCA	VAN	VBN	VCN	A-B	B-C	C-A	A-G	B-G	C-G
A														
B														
C														
D														
E														
F														
G														

1. Refer to raceway and wire schedule and one-line diagram for description of feeder identified by label shown on this report
2. Visual Inspection – Check when completed
3. Continuity Test – Check when completed

17.00 GENERAL

This division covers all work necessary for furnishing, installing, adjusting, testing, documenting, and starting-up the Instrumentation and Control (I&C) and Telemetry System.

Sections in these specifications titled "*Common Work for . . .*" shall apply to all following related subsections whether directly referenced or not.

These specifications are an integral part of the contract documents for the I&C and Telemetry portion of this contract. The written descriptions of system performance contained herein are given to assist the Contractor in interpreting the contract plans but are not intended to be all-inclusive. The Contractor shall be aware that all automatic control systems do not require the same components and accessories for complete system operation. Therefore, these specifications do not include all accessories and appurtenances required for a complete system. The Contractor shall, however, provide all accessories and appurtenances to result in a completely operational system as required to meet the functional requirements of these documents. Where specific equipment specifications are given, they are used to represent the level of quality required by these documents.

17.05 Common Work for Automatic Control

Part 1 - General

Summary

The work under this division covers construction specifically described in these specifications. Project Plans will be provided for this project. All work incidental and necessary to the completion of the project described herein shall be completed under the bid item listed in the bid proposal, and no other compensation will be allowed. The work generally consists of the following:

- Detailed system layout and design for the particular equipment bid in accordance with these functional specifications.
- Furnishing of I&C equipment including delivery, storage, software, programming, installation, testing, startup, and documentation.
- Providing operator maintenance manuals for all equipment and devices provided by this Contract.
- Providing system training to the operators of the proposed equipment.

Related Sections

- Division 16 Electrical

References

The project Plans are based on Instrument Society of America (ISA) standards numbers S5.1, S5.2, S5.3, and S5.4. The Contractor is encouraged to be familiar with these standards since

the project plans do not contain wiring or ladder diagrams, but are based on the functional requirements of the ISA format.

All equipment and materials shall conform to the latest revised editions of applicable standards published by the following organizations:

- American National Standards Institute (ANSI).
- Institute of Electrical and Electronic Engineers (IEEE).
- National Electrical Manufacturers Association (NEMA).
- Underwriters' Laboratories (U/L).
- Instrument Society of America (ISA)

All equipment and materials, and the design, construction, installation, and application thereof shall comply with all applicable provisions of the National Electrical Code (NEC), the Occupational Safety and Health Act (OSHA), and any applicable Federal, State, and local ordinances, rules and regulations. All materials and equipment specified herein shall be within the scope of Underwriter's Laboratory (UL) examination services, be approved by the UL for the purpose for which they are used and shall bear the UL label.

All control panels shall bear a label by UL or by an approved testing authority for the completed assembled panel.

Definitions

Contractor: The Contractor shall install all panels, equipment, and instrumentation and provide all materials and work necessary and thereby, satisfy all requirements that are within the scope of this section.

Control System Integrator: A single firm preselected by the Owner and subcontracted by the Contractor, who shall design and furnish the system, provide the instrumentation, VFD panels, assemble and test the control panel equipment, program existing PLCs, computers, and other instrument components, and provide start-up and training services. The Control System Integrator for this contract shall be:

Quality Controls Corporation
Mr. James Cross
5015 208th Street SW, Suite 1B
Lynnwood, WA 98036
O 425.778.8280 | jamesc@qcchome.com

Submittals

All submittals shall be complete, neat, orderly and indexed. Partial submittals will not be accepted. Submittal information shall be provided to the Owner for the following items:

- Pressure Transmitter
- In addition to the requirements of Division 1.33, the Contractor shall develop and submit the following information.

Hardware Submittals

Before any components are fabricated, and/or integrated into assemblies, or shipped to the site, the Contractor shall prepare a complete hardware submittal. The Engineer shall require five (5) sets, including fully detailed shop drawing, catalog cuts, wiring connections, and such other descriptive matter and documentation as may be required to fully describe the equipment and to demonstrate its conformity to these Specifications. The decision of the Engineer, upon the acceptability of any submittal, shall be final. Catalog information shall be submitted for all components and equipment, regardless of whether or not it is of the same manufacture as that listed in the Specifications.

Site Conditions

Specified instrumentation and control equipment shall be modified, if necessary, to make it suitable for operation in the ambient conditions.

Part 2 – Products

Components

These Specifications list major instruments required to provide the process instrumentation system. All instrument functions specified on this list shall be provided by the Control System Integrator. Any additional instruments required to complete the instrument loops because of certain characteristics of the particular equipment selected by the Control System Integrator shall be provided. Such additional instruments shall be provided and included in the original contract price even though not specified in the instrument index or on the Plans.

The following systems utilize automatic control:

- Pump controls

Accessories

Provide all accessories required to furnish a complete control system that meets the requirements of the Plans and Specifications.

Source Quality Control

Material shall be new, free from defects, and of the quality specified. All equipment and materials utilized in the system shall be the products of Manufacturers with at least five (5) years of experience in the manufacture of similar equipment. Similar items in the system shall be the products of the same Manufacturer. All equipment shall be of industrial grade and of standard construction, shall be capable of long, reliable, trouble-free service, and shall be specifically intended for control and monitoring of operation of motor-driven pumps and equipment. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing.

Part 3 - Execution

Installers

Installation shall be performed by the workers who are skilled and experienced in the installation of I&C and Telemetry systems.

Installation

Installation and testing procedures shall be as specified in these and subsequent sections of this division.

The control system shall be installed in accordance with the installation plans and instructions prepared by the Control System Integrator.

Installation shall include all elements and components of control system and all conduit and interconnecting wiring between all elements, components, sensors, and valve operators.

Equipment shall be located so that it is readily accessible for operation and maintenance.

Field Equipment

Equipment shall be provided as specified on the Plans such that ports and adjustments are accessible for in-place testing and calibration. Where possible, equipment shall be located between 48 inches and 60 inches, unless specified otherwise on the Plans, above the floor or a permanent work platform. Instrumentation equipment shall be mounted for unobstructed access, but mounting shall not obstruct walkways. Equipment shall be mounted where shock or vibration will not impair its operation. Support systems shall not be attached to handrails, process piping or mechanical equipment except for measuring elements and valve positioners. Instruments and cabinets supported directly by concrete or concrete block walls shall be spaced out not less than ⅝-inch by framing channel between instrument and wall.

Steel used for support of equipment shall be hot-dip galvanized after fabrication. Support systems including panels shall be designed in accordance with the Seismic Restraint and Anchorage section of Division 1.81 of these specifications and to prevent deformation greater than ⅛-inch under the attached equipment load and an external load of 200 pounds in any direction.

Electrical Power Connection

Electric power wiring and equipment shall be in compliance with Division 16. Power disconnect switches shall be provided within sight of equipment and shall be labeled to indicate opened and closed positions and specific equipment served. "Within sight of" is defined as having a clear unobstructed view from the equipment served and within 50 feet of the equipment served. Disconnect switches shall be mounted between 36 inches and 72 inches above the floor or permanent work platform. Where equipment location is such that the above requirements cannot be met by a single disconnect switch, two switches, one at the equipment and one at the work platform, shall be provided.

Signal Connection

Electrical signal connections to equipment shall be made on terminal blocks or by locking plug and receptacle assemblies. Jacketed flexible conduit shall be used between equipment and rigid raceway systems except that flexible cable assemblies may be used where plug and receptacle assemblies are provided and the installation is not subject to mechanical damage in normal use. The length of flexible conduit or cord assemblies shall not exceed 2 feet. Flexible cable, receptacle and plug assemblies shall be used only where specified.

17.06 Control System Integrator

Part 1 - General

Division of Responsibility

All instrumentation and industrial electronic systems shall be provided under the supervision of a single Control System Integrator, Quality Control Systems (QCC), which is regularly engaged in the design and installation of such systems of similar scope and complexity. The Control Systems Integrator shall be enjoined by the Contractor as a Subcontractor. The assignment of specific responsibilities herein to the Control System Integrator shall not, in any way and under any conditions, diminish the Contractor's full and complete responsibility for all work performed and all materials installed under the contract. The contract between the Contractor and the Control System Integrator shall specifically require that the Control System Integrator conform to and meet all requirements specified in the contract documents.

The assignment of a Control System Integrator that is an equipment supplier shall not be acceptable.

Control System Integrator's Responsibility

The Control System Integrator shall be solely and completely responsible for the final design and assembly of the entire control system. Responsibilities include:

- Provision of, and the detailed design of, custom control panels. The plans show general layout of the control panels. The Integrator shall provide detailed scaled design of all components on and in the control panels and determine specific requirements.
- Provision of instrumentation.
- The design of all interconnecting wiring of control equipment including remote control panels, packaged equipment panels, mechanical equipment with control components, etc.
- Testing of the control panels in the Control System Integrator's shop.
- Coordinate with the Contractor for specific requirements and locations of raceway penetrations and field wiring in control panels.
- The Control System Integrator shall supply the Contractor with all necessary detailed installation plans and/or written instruction for installation of all control components and sensing devices for proper system operation.
- Provide installation assistance.
- Programming of the existing PLC's.
- Programming of the graphical touch screen operator interfaces (OI) on the existing control panels.
- MTU and Human Machine Interface (HMI) programming at the Owner's Headquarters.
- Provide Startup and Training Services.

General and Electrical Contractor's Responsibilities

The General and Electrical Contractor shall be responsible for the following equipment and services:

- Review of the Control System Integrator's submittals and wiring diagrams for coordination with space requirements, raceway requirements of field wiring, etc.
- Supply the Integrator with submittals of equipment related to the control system that the Integrator must include in their submittals and integrate. Such as motors, packaged control panels that the Integrator does not build, etc.
- Installation of the control panels provided by the Control System Integrator.
- Installation of the interconnecting wiring in accordance with these documents and the Control System Integrators wiring diagrams.
- Installation of I&C and Telemetry System components in accordance with these documents and plans or instructions of the Control System Integrator.

Part 3 – Execution

Installers

The Control System shall be designed, constructed, programmed and commissioned by full time employees with a minimum of 5 years of experience (minimum of 1 year with Integrator).

The Control System Integrator shall be:

- **Quality Control Corporation, Lynnwood, WA.**

17.50 SENSORS AND CONTROLS

17.50.1 Common Work for Sensors and Controls

Part 1 – General

Design Requirements

Provide sensors and controls scaled and rated for their intended application.

Part 3 – Execution

Installation

All devices shall be installed to be field serviceable without taking the facility out of service. Readouts shall be positioned to be easily read from a standing position, central to the room unless allowed otherwise by the Engineer.

17.52 Pressure and Level Sensors and Controls

17.52.5 Pressure Switches

Part 1 – General

Design Requirements

Provide pressure switches that are surface mount type with ¼-inch or ½-inch NPT bottom fittings (or as shown on the plans if different) and completely suitable for operation when connected to potable water. All wetted parts shall be brass or stainless steel; no aluminum will be allowed. Provide unit with clear Lexan cover over trip settings that are screwdriver adjustable and displayed in psi. Housings shall be NEMA 4 rated with waterproof conduit connections.

Select switches to provide suitable over-pressure protection for specific pressure range involved at each location. Sensors shall be seamless brass or stainless steel. Setpoints shown are estimates and may require adjustment at startup.

Location	Scale Range	High Setpoint
W1-1 Discharge	0-200 psi	140 psi
W1-2 Discharge	0-200 psi	140 psi
W1-3 Discharge	0-200 psi	140 psi

Part 2 – Products

Manufacturers

United Electric 400 series, or equal.

Part 3 – Execution

Installation

Install switches as shown on the Plans. If not shown, securely install and mount in a location approved by the Owner.

17.52.10 Gauge Pressure Transmitter

Part 1 – General

Design Requirements

Provide transmitter with ¼-inch or ½-inch process connections or as shown on the plans if different, and completely suitable for measuring pressure in potable water. Select ranges to provide a system that utilizes the largest percentage of available span for each transmitter. Transmitter shall transmit in pounds per square inch displayed at the device screen and through the 4-20mA output.

Location	Low end of range	High end of range (minimum)	High end of range (maximum)
Suction pressure	10 psi	20 psi	60 psi
Discharge pressure	90 psi	140 psi	220 psi

Part 2 – Products

Manufacturers

Pressure transmitter shall be Foxboro IGP10, Endress+Hauser Cerabar S PMP71, Siemens Sitrans P DS III, or equal.

Manufactured Units

Pressure transmitters shall be all solid state with a 4-20ma output. All wetted parts shall be stainless steel. Transmitter shall be hermetically sealed to withstand submergence or an operating environment of 100 percent humidity for an indefinite period of time. Total error band shall not exceed 0.25 percent of full scale over a temperature range of 0-100 degrees Celsius. Voltage input shall be 9 to 20 VDC without more than a 0.12 percent change in output. Volumetric displacement of bridge from 0 psi to max-rated pressure shall be less than 0.01 cubic inches. Provide electronics with built-in protection against AC line transients and lightning spikes, and an R/F filter to reject external electrical and internal noise. Zero and span adjustments shall be non-interacting.

A digital indicator with on-board pushbuttons shall be provided to display the measurement with a choice of units. The pushbuttons shall allow zero and span adjustments and local configuration without the need for a hand-held terminal.

Part 3 – Execution

Installation

Transmitter installations shall be equipped with drain and bleed and isolation valves to remove air from transmitter diaphragm. Contractor shall be completely responsible for proper operation and interface of transmitter with other electronics provided on the project.

17.90 TESTING, STARTUP, AND TRAINING

17.90.1 Common Work for Testing, Startup, and Training

Part 1 – General

Summary

Total system hardware start-up is the responsibility of the Control System Integrator.

Maintenance

The Control System Integrator shall be solely and completely responsible for all hardware maintenance of the system from time of start-up to the date of acceptance, by formal action of the Owner, of all work under the contract. The Control System Integrator shall perform all

such work required or considered to be required by the Owner to cause and maintain proper operation of the system and to properly maintain the system.

Warranty

The Contractor shall cause the Control System Integrator to make any and all repairs, replacements, modifications and adjustments required to eliminate any and all defects in design, materials and workmanship which are disclosed within the one year guarantee period. The Control System Integrator shall begin all repairs, replacements, modifications and adjustments within twenty-four (24) hours of notification by telephone by the Owner and shall complete such repairs, replacements, modifications and adjustments within forty-eight (48) hours of notification. Should the Control System Integrator fail to begin the work within 24 hours or complete the work within 48 hours, the Owner may proceed to undertake or complete the work. In such event, the Contractor and his surety shall be liable for all costs incurred by the Owner.

Part 3 – Execution

Field Quality Control

Equipment Manufacturer's Support

1. The Control System Integrator shall pay for services of equipment manufacturer's field service representative(s) to:
    a. Inspect equipment covered by these Specifications.
    b. Supervise adjustments and installation checks.
    c. Conduct start-up of equipment and perform operational checks.
    d. Provide Owner with a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

Repairs

The Control System Integrator shall correct all deficiencies and defects and make any and all repairs, replacements, modifications, and adjustments as malfunctions or failures occur.

The Contractor and the Control System Integrator shall anticipate that the Owner may delay acceptance of all work under the contract if, in the judgment of the Owner, malfunctions or failures in operation of the control system repeatedly occur after start-up. Both the Contractor and the Control System Integrator shall not be entitled to an extension of time or to any claim for damages because of hindrances, delays or complications caused by or resulting from delay by the Owner in accepting the work because of malfunctions or failures in operation of the control system.

17.91 Tests and Inspections

Part 1 - General

Summary

Materials, equipment, and construction included under this specification shall be inspected in accordance with the specifications. Testing shall be performed by the Control System

Integrator in accordance with Division 16, and this and subsequent sections of this division. Testing shall be required to determine if installed equipment and system(s) will operate in the manner in which they are intended to operate. The decision of the Owner upon the acceptability of the test procedures and conformance shall be final. The work will not be accepted until all testing has been satisfactorily performed.

Scheduling

The Contractor shall prepare field test procedures to demonstrate conformance of the complete system to this specification. The Contractor shall submit the detailed test procedures within four weeks after the notice to proceed for the Engineer's review and approval.

The Contractor shall furnish all labor, materials, tools, equipment, instruments and services necessary to perform all specific functional testing of all installed equipment and systems at no additional cost.

The Contractor and Control System Integrator shall submit to the Engineer a detailed field testing schedule identifying each day that the Engineer will need to be on site for field testing of equipment. A preliminary schedule shall be submitted to the Engineer for review 60 days before testing. A final schedule shall be submitted to the Engineer for review 30 days before testing. Once the scheduled days are confirmed by the engineer, they are required to be included in the monthly schedule updates.

Part 3 – Execution

Field Quality Control

Following installation by the Contractor, the Control System Integrator will verify the correctness of the interconnecting wiring and energize all control equipment in the field. Each point at the controller(s) shall be checked for proper functional operation through communication with the central computer.

Field Tests

The Control System Integrator in conjunction with the Contractor shall conduct field tests of all VFDs and instrumentation in the presence of the Engineer after installation of the equipment at the site. Testing shall be conducted by physically actuating signaling devices, installing temporary jumpers, or artificially imposing signals on the field wiring. This shall be done to establish proper operation of the field devices, the integrity of the field wiring, and the proper connection of field devices to the panels. The Contractor and Control System Integrator shall coordinate with the Engineer to provide for as complete testing of the control system as is practical prior to placing the equipment on line for actual control and monitoring. The Contractor and Control System Integrator shall make corrections or repairs to the wiring and/or devices as necessary to provide proper operation of the system.

After the initial testing is complete, commissioning shall be accomplished by the Control System Integrator and Contractor, with the Owner and Engineer present. Commissioning shall include operation and verification of all control components and features of the entire control system. Each function shall be demonstrated to the satisfaction of the Owner.

Repairs

Should any part of the system fail during the test, the test shall be rescheduled and repeated to the satisfaction of the Owner after repairs.

17.92 Startup

Part 1 – General

Summary

All testing, startup and operation shall not be cause for claims for delay by the Contractor, and all expenses accruing therefrom shall be deemed to be incidental to this contract. The Contractor shall make arrangement for all materials, supplies and labor necessary to efficiently complete the testing, startup and operation.

Startup shall consist of testing, by a simulated operation, all operational equipment and controls. The purpose of these tests shall be to check that all equipment will function under operating conditions, that all interlocking controls and sequences are properly set, and that the facility will function as an operating unit.

Scheduling

Factory representatives of all major units shall be present for the startup phase. The test shall continue until it is demonstrated that all functions of controls and machinery are correct.

Part 3 - Execution

Field Quality Control

When the installation of the Control System is substantially complete, the Contractor shall commence with calibration and field testing. Testing shall determine that all system components connect up correctly to each other so that the system works as designed. Refer to section 17.91 for field testing requirements.

All components of the control system shall be calibrated by the Contractor after completion of installation. Each component shall be adjusted to be within the Manufacturer's required range and for the specific application.

Components that cannot be properly calibrated or that are found to exceed the Manufacturer's specified range or accuracy shall be removed and replaced at no additional cost to the Owner.

The control system shall be placed into operation by the Control System Integrator.

The Control System Integrator shall calibrate all instruments, indicators, recorders, loops, etc. and shall provide a five-point calibration test results sheet for each calibrated instrument. The five-point calibration shall include one point at: Minimum input range value, Maximum input range value, Midrange input value, no other point less than 25 percent of span to any other point. Test forms shall identify each instrument tested, input conditions vs. output signal results in tabulated form, and shall be submitted to the Engineer prior to final commissioning.

Repairs

All deficiencies observed during the start-up will be corrected by the Contractor.

17.94 Documentation

17.94.2 Operations and Maintenance Manuals

Part 1 – General

Summary

Two types of operation and maintenance manuals (O&M) will be required for the contract:

1. General manuals for use by the Water Department staff for daily operation, maintenance and troubleshooting.
2. Technical manuals for use by trained electronics technicians for technical and "board level" maintenance and repair.

Submittals

Prior to the receipt of payment for more than 50 percent of the work, the Contractor shall deliver to the Owner five sets of acceptable manufacturer's operating and maintenance instructions covering each piece of mechanical and electrical equipment, or equipment assembly, furnished under this contract. Each set of instructions shall be bound into multiple volumes; each volume to be complete with an index and bound in a suitable hard-cover binder. Manuals shall be assembled and indexed so that information on each piece of equipment can be readily found.

Quality Assurance

Manuals shall be purposefully made for this installation, and general manuals which are vague or have limited applicability will not be accepted. The manuals shall be written in a non-technical format suitable for reading by water system operators with no previous automatic control equipment experience. The decision of the Owner on the acceptability of the manual shall be final.

Part 2 – Products

Materials

The Control System Integrator shall prepare and assemble detailed operation and maintenance manuals in accordance with the project general requirements. The manuals shall include, but not be limited to, the following:

1. Name, location and phone number of nearest supplier and spare part warehouse.
2. Step by step operating procedures.
3. Narrative of overall system performance and operation.
4. Listing of all equipment setpoints.
5. Preventative maintenance procedures
6. Trouble-shooting of master and remote equipment.
7. Calibration
8. Testing

9. Replacement of components
10. System schematics / shop drawings
11. As-built elementary and one-line diagrams
12. Catalog data and complete parts list for all equipment and control devices
13. Listing of recommended spare parts.
14. Listing of recommended maintenance tools and equipment.
15. Warranties.
16. Disassembly and reassembly instructions.
17. Program documentation printout with tag numbers and descriptive comments.
18. Backup program on CD-ROM or flash drive.

All plans shall be provided on hard copy and in electronic form on disk. Electronic drawing files shall be provided in AutoCAD .DWG format with all "xrefs" bound. If "xrefs" are not bound, all "xref".DWG files shall be provided unlinked with instructions to reestablish the links. Files shall be in AutoCAD 2010 or later format.

Division 18
Measurement and Payment

18.0 GENERAL

It is the intention of these specifications that performance of work under bid items shall result in complete construction, in proper operating condition, of improvements identified in these written specifications and accompanying plans. Work and material not specifically listed herein but required according to the plans and specifications and general practice shall be included in Contractor's bid price in the most closely applicable bid item.

If a minimum bid amount has been established for any item and the bidder's entry is less than the minimum specified amount, the Owner will unilaterally revise the price to the minimum specified amount and recalculate the total. The recalculated total will be used by the Owner for award purposes and to fix the contract price amount and the amount of the contract bond.

If a maximum or fixed bid amount has been established for any item and the bidder's entry exceeds the maximum or fixed specified amount, the Owner will reduce the bid item price to the maximum or fixed specified amount and relocate the offsetting amounts to bid items of the Owner's choosing.

Bid Item 1 – Mobilization, Demobilization, Site Preparation, and Cleanup

Lump sum price covers complete cost of furnishing, installing and testing, complete and in-place, all work and materials necessary to: move and organize equipment and personnel onto the job site; secure job site; traffic control for deliveries; provide and maintain necessary support facilities; obtain all necessary permits and licenses; prepare site for construction operations; maintain site and surrounding areas during construction, move all personnel and equipment off site after contract completion, cleanup site prior to final acceptance; and accomplish all other items of work not specifically listed in other divisions.

No more than 80-percent of bid amount for this item will be paid before final payment request, and this bid amount may not be more than 10-percent of value of total contract.

Bid Item 2 – Contractor Health and Safety Plan, Site-Specific Safety Plan, and Spill Prevention Control and Countermeasure (SPCC) Plan

Lump sum price covers complete cost of writing, submitting, editing, and finalizing the Contractor Health and Safety Plan, Site-Specific Safety Plan, and Spill Prevention Control and Countermeasure (SPCC) Plan as described in the General Conditions. Plans shall be approved and complete by the second pay estimate.

Bid Item 3 – Pump Station Mechanical

Lump sum price shown shall cover the complete cost of providing all labor, materials, and equipment necessary for the mechanical work shown on the Plans and not included in other bid items, as detailed in the contract specifications, including the decommissioning and proper disposal of the existing pumps, piping, fittings, valves, tanks, and other hardware near and adjacent to the pumps and indicated for removal in the pump station building except for the Raw Water pumps, motors, and fittings identified on the plans as Additive Alternative No. 1.

Bid Item 4 – Magnetic Flow Meter Installation

Lump sum price shall cover the complete cost of providing all labor, materials, and equipment necessary to install the furnished magnetic meter and pressure transducer, including pipe spool, fittings, and valves adjacent and near the meter location as shown on the plans and detailed in the contract specifications.

Bid Item 5 – Pumps and Motors

Lump sum price shown shall cover the complete cost of providing all labor, materials and equipment necessary for each of three (3) W pumps, electric motors, and concrete pump pads as shown on the Plans and detailed in the contract specifications.

Bid Item 6 – Pressure Tanks and Mechanical

Lump sum price shown shall cover the complete cost of providing all labor, materials, and equipment necessary for the pressure tanks and mechanical work adjacent to the tanks to the connection to existing pipe as shown on the Plans and detailed in the contract specifications, including all piping, tank mechanical, coatings and equipment.

Bid Item 7 – Electrical

The lump sum price shown shall cover the complete cost of providing all labor, materials, and equipment necessary for the electrical work shown on the Plans and detailed in the contract specifications.

Bid Item 8 – Control System by QCC

The lump sum price shall cover the complete cost of supplying the 40 hp VFD panels, 10-inch magmeter with remote transmitter, discharge pressure gauges and switches, discharge pressure transmitter, tank line pressure gauge, custom pressure mounting assemblies, all required custom PLC/OIT/SCADA and communications programming services required to integrate the new equipment and signals into the existing control system, factory certified VFD startup/commissioning, VFC harmonic analysis calculations, VFD on-site testing services, and startup, commissioning, and training for all equipment and services as shown on the Plans, detailed in the contract specifications, and described in the Contract Documents.

Bid Item 9 – Control Systems Coordination

Lump sum price shown shall cover the complete cost of providing all labor, materials, and equipment necessary for the automatic control system as shown on the Plans and detailed in the contract specifications. **This does not include labor, materials, and equipment supplied by Quality Controls Corporation as detailed in Bid Item 8.**

Bid Item 10 – Testing, Startup, and Training and Commissioning

Lump sum price shown shall cover the complete cost of providing all labor and materials necessary for testing, startup, training and commissioning of the project elements as shown on the Plans and detailed in the contract specifications. Payment shall be lump sum. Payment shall not be paid until testing of the station is complete, and the pump station is completely operational, commissioned and staff trained as determined by the Owner and Engineer.

Bid Item 11 – Operation and Maintenance Manuals

Lump sum price shall cover the complete cost of providing all labor and materials necessary to provide two (2) hard copies and one (1) electronic copy of the Operations and Maintenance Manuals as described in the specifications and train the Owner's personnel on site with manufacturer-certified representatives for the following items: Pumps and Motors; Power and Telemetry equipment as shown on the Plans and detailed in the contract specifications. Partial payment of up to 20 percent of the total bid item cost is allowed prior to initial owner training. Final 80 percent of payment shall not be paid until Operations and Maintenance Manuals are determined complete by the Owner and Engineer.

Bid Item 12 – Construction Records

Lump sum price shown shall cover the complete cost of providing all mark-up plans necessary for the Owner to create accurate as-built records as detailed in the specifications. The work includes surveying all structures and utilities to determine their as-constructed locations and elevations. Failure to comply with the as-built requirements and furnish acceptable as-built records will result in the deletion of this bid item by change order. Payment for this work will not be made prior to the final payment.

Additive Alternate 1 – Remove and Dispose of Existing Raw Water Pumps

The lump sum price shall cover the complete cost of removing, capping, and disposing of the existing five raw water pumps, motors, and discharge pipe as shown on the Plans.

APPENDIX A

PUD FORMS

W1 PUMP SYSTEM REPLACEMENT PROJECT

SUBSTITUTION REQUEST No. _____

(To be used for substitutions prior to bid – Deviation Requests are used after bid)

To: Public Utility District (PUD) No. 1 of Skagit County Project: W1 Pump System Replacement Project

We hereby submit for consideration the following product instead of the specified item for the above project:

Section	Page	Paragraph	Description

The undersigned requests consideration of the following:

Proposed Substitution: _____

Attach complete technical data, including laboratory tests and samples, as applicable. Compare the significant qualities (size, weight, durability, performance and similar characteristics, and including visual effect where applicable) of the proposed substitution with the original requirements. List complete installation changes and changes to Drawings and Specifications required by proposal.

A. Does substitution require changes in Drawing dimensions? _____

B. Will Undersigned pay for resulting design changes including engineering and detailing costs? _____

C. What effect does substitution have on other trades? _____

D. Differences between proposed substitution and specified item: _____

_____

E. Manufacturer's guarantees of proposed and specified items are: _____ Same _____Different (explain on attachment)

F. Contract completion date is: _____ Same _____Different_____ New Date

The undersigned states that the following paragraphs, unless modified on attachments or otherwise stated, are correct:

1. The proposed substitution does not affect dimensions shown on Drawings and will not require a change in any of the Contract Documents.

2. The undersigned will pay for changes to the design, including engineering design, detailing, and construction costs caused by the request substitution which is estimated to be $_____.

3. The proposed substitution will have no adverse effect on other contractors, the construction schedule (specifically the date of substantial completion), or specified warranty requirements.

4. Maintenance and service parts will be locally available for the proposed substitution.

5. The incorporation or use of the substitute in connection with the work is not subject to payment of any license fee or royalty. Undersigned attest's function and quality is equivalent or superior to specified item and waives their right to additional payment and time which may subsequently be necessitated by failure of the substitution to perform adequately and for the required work to make corrections thereof.

Submitted by Contractor:

_____Date _____
Signature

_____Phone _____
Firm

_____Fax _____

_____Email_____
Address

Reviewed by Engineer:

___Accepted ___Accepted as Noted
___ Not Accepted ___Received Too Late

By _____

Date _____

Attachments:

DEVIATION REQUEST FORM File No. _____

(To be used for deviations after bid – Substitution Requests are used prior to bid)

To: **Public Utility District (PUD) No. 1 of Skagit County** Contractor:

Project: Project No.

Date _____

Subject _____

Sheet No. _____ Specification _____

Original Contract Requirements:

Reason for Deviation Request:

Proposed Deviation:

Any change in contract time or cost? _____

Proposed: Accepted ☐ Not Accepted ☐

_____ _____

Contractor's Signature Engineer's Signature

Distribution:

1. **Contractor**
2. **Owner**
3. **Engineer**
4. **Construction Manager**
5. **Owner's Project Files**

For all contractor submittals, including shop drawings, samples calculation, data, or other	Date	Transmittal No. Example – 001 - Resubmittal 001.1

Project Name: **JUDY WATER TREATMENT PLANT W1 PUMP SYSTEM REPLACEMENT PROJECT**

Owner: Skagit PUD No. 1	Contractor:
Attention: Mike Benton - Project Manager	Attention:
Address: 1415 Freeway Drive PO Box 1436 Mount Vernon, WA 98273	Address:
Action Legend: A – Furnish As Submitted B – Furnish As Noted C – Revise and Resubmit D – Rejected E – Engineer's Review Not Required	This is: Check one [X] an original submittal [ ] a 2nd submittal [ ] a ____ submittal

Item No.	Description	Spec Section or Drawing No.	Action Taken
001-01	Sub Item Title – Example Vaults	05 1200	
001-02			
001-03			
001-04			
	Resubmittal for specific sub item 001.1-01		

District Reviewer:

Contractor to complete either (a) or (b), following:

[X] (a) We have verified that the materials or equipment contained in this submittal meets all the requirements specified or shown (no exceptions)

[ ] (b) We have verified that the material or equipment contained in this submittal meets all the requirements specified or shown, except for the following deviations (List Deviations):

Contractor's Authorized Representative _____

APPENDIX B

QCC PROPOSAL & SCOPE FOR CONTROL SYSTEM COMPONENTS

W1 PUMP SYSTEM REPLACEMENT PROJECT

QUALITY CONTROLS CORPORATION
5015 208th St. SW, Suite 1-B Lynnwood, Washington 98036
Phone (425) 778-8280 www.qualitycontrolscorp.com

Proposal

March 3, 2025 Quote Number: Q4533

To: Public Utility District No. 1 of Skagit County
Attn: Kurt Van Burkleo

Project: Judy Raw Water Treatment Plane W1 Pump System Replacement

Reference:

15.50	Flow Meters
15.60	Pressure Measurement
16.30	Basic Panel Equipment and Devices
16.40	Low Voltage Motor Control Equipment
16.45	Variable Frequency Drives
Division 17	Automatic Control
Addenda:	None Received

Bid Date: TBD Bid Close: TBD

Terms: Net 30
FOB: Lynnwood, WA
Freight: Prepaid and allowed

This quote is valid for 90 days.

QCC is pleased to provide quotation for the above referenced project. Quality Controls Corp. (QCC) provides services and materials, FOB Lynnwood, WA, complete, ready for installation and field termination by others. QCC's quoted price does not include tax or the cost to bond this project.

Please call me with any technical questions or if you have any questions concerning the pricing on this quotation.

Sincerely,
David Chu

5015 – 208th Street S.W. Unit 1B Lynnwood, Washington 98036
Phone: 425.778.8280 Fax: 425.778.4541
Email: DavidC@Quality-Controls.com

Pricing

Total Price for the Scope of Work Detailed Below **$ 208,230.00**

Scope of Work

1. QCC supplies the following Motor Control Equipment for installation and field termination by others:
    - W1-1 VFD 40HP VFD Panel
    - W1-2 VFD 40HP VFD Panel
    - W1-3 VFD 40HP VFD Panel

    All VFD panels supplied by QCC will be UL listed and contain all required components and sub-assemblies.

2. QCC supplies all control hardware required for field modifications made to the existing RTU Telemetry Control Panel by others. QCC will supply CAD-based installation drawings and provide support services as required to assist the contractor with the equipment installation.

3. QCC provides the following process instrumentation for installation and field termination by others:
    - QTY (1) W1 Discharge 10" Magnetic Flow Meter & Remote Transmitter
    - QTY (1) W1 Discharge Pressure Transmitter
    - QTY (1) W1 Discharge Pressure Gauge
    - QTY (3) W1 Pump Discharge Pressure Gauge
    - QTY (1) Tank Line Pressure Gauge

4. QCC provides all required custom PLC, OIT, SCADA, and communications programming services required to integrate new equipment and signals into the existing control system.

5. QCC will host the witnessed factory testing at our Lynnwood, WA facility for all control panels included in this proposal.

6. QCC supplies factory certified VFD startup and commissioning, harmonic analysis calculations, and on-site testing services for all VFDs included in this proposal.

7. QCC provides field start-up, commissioning, and training as required for all equipment and services included in this proposal.

8. QCC provides CAD-based drawings, Bill of Materials, and Operation and Maintenance manuals for all components included in this proposal.

Clarifications and Exclusions

1. QCC specifically excludes the following material and services:
    - Arc Flash, Short Circuit Coordination, Harmonic, NETA Testing Services and Reports
    - Switchboard and MCC Modification Materials and Services
    - Custom Pressure Device Mounting Assembly (Sheet M05, Detail 105) QCC will supply the pressure devices loose for custom mounting by others.

2. Section 16.45 specifies Powerflex 755TL Low Harmonic Active Front End VFDs. Plan Sheets E02 and E06 show Passive Harmonic Filters for each VFD. This proposal is based on 755TL VFDs and does ***NOT*** include additional harmonic filters. QCC can provide standard 6-Pulse VFDs with Passive Harmonic Filters at the same price if preferred.

3. QCC provides the following unless specifically excluded on our bill of material:
    - Equipment shipped FOB factory with freight allowed, tailgate, destination.
    - Field wiring diagrams showing interconnection of field instruments and instrumentation panels.
    - Instruction manuals as required.
    - All necessary field start-up and calibration of the equipment we supply.

4. QCC does ***NOT*** provide the following unless specifically included in our bill of material:
    - Pipe, tubing, valves or fittings between the instrument and the process.
    - Conduit, wire or cable not integral to instrument or control panels supplied by QCC.
    - Mounting brackets, stanchions, supports or mounting pads not an integral part of the instrument.
    - Labor to install the equipment.
    - The Cost, (if due to local union regulations), to have local craftsman make adjustments or wiring modifications to our equipment during start-up and calibration.
    - Any material or services not in our quoted sections.